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AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 16 DECEMBER, 1933 NUMBER 12

THE MECHANISM OF SENILE CATARACT

DANIEL B. KIRBY, M.D.
NEW YORK, N.Y.

The features of senile cortical cataract are produced by colloidal fluid which has been extruded from its combination with the lens protein or has been attracted through the capsule which has been changed in its permeability. In the incipient stage, this fluid may produce an ill-defined cortical haze or may diffuse along interfibrillar spaces to reach the capsule where it collects in the form of the so-called vacuoles or globules, or it may distend the sutures or interlamellar spaces to form the familiar water-split sutures or separated lamellae. Senile nuclear cataract represents an excessive sclerosis and dehydration of the nuclear and later of the cortical lens material. Study of the formation of cataract in tetany led to the opinion that a disturbance of the inorganic ions takes place, which is sufficient to affect the transparency of the labile colloidal solution of the lens protein. Cataracts in diabetics present features similar to those of the senile cortical form. The hypothesis is expressed that the various phenomena exhibited in the mechanism of senile cataract are those of disturbances of permeability. The structures affected in the eye are the blood vessels and the tissues of the semi-permeable ciliary epithelial membrane, the lens capsule, the lens fibers and the interfibrillar diffusion spaces. The cause of these disturbances in permeability may be chemical, physical or dependent on metabolic changes in the general system. The material for this thesis was gathered while the author was Research Fellow for the American Academy of Ophthalmology and Oto-Laryngology. From the Department of Ophthalmology, College of Physicians and Surgeons, Columbia University. Read before the Association for Research in Ophthalmology, in Milwaukee, June 13, 1933.

Many avenues of approach to the subject of the etiology of senile cataract are possible. Fundamental laboratory studies as well as clinical investigations are necessary. I have attempted to correlate the knowledge that has been gained through the research of others and my own and to develop a concept of what may be called the mechanism of senile cataract. Proper acknowledgment of all the sources of information is not possible within the scope of the paper. Suffice it that part of it is original and part simply an interpretation of the ideas of others.

By "the mechanism of senile cataract" is understood the mode of production of opacities in the crystalline lens of the elderly. Both the incipient as well as the subsequent changes that lead to progressive loss of transparency of the lens may be considered as well as any physical or chemical factors that may be involved in the process.

A number of interesting points may be brought out by considering certain features of the applied anatomy and pathology of the crystalline lens.

Applied anatomy and pathology of the crystalline lens

A. The Aqueous Humor (the vehicle for nutrition and metabolism of the lens).
B. The Capsule (the selective semipermeable membrane of the lens).
C. The Epithelium (the formative and secreting mechanism of the lens).
D. The Cortex (the more recently formed lens fibers). The Transparency of Tissue.
E. The Nucleus (the older and more compact lens fibers).

The aqueous humor. The aqueous humor is most probably formed by dialysis through the semipermeable membrane of the ciliary epithelial cells, which may add a special secretory substance. In the embryo, the anlage of these cells is responsible for the origin and transparency of the lens. The retinal pigment epithelial cells, which are similar in structure, produce a highly specialized secretion, the visual purple. One may assume that the ciliary epithelium secretes a substance that controls the growth, nutrition, and transparency of the lens. Although not directly proved, this is an interesting idea as a working hypothesis. Failure or im-

pairment of secretion of this substance would result in faulty nutrition of the lens with resulting changes which would affect its transparency. I have extracted a substance from the uveal tissues of the eyes of beef, using the same technic that is used in producing insulin, but have made no use of the extract and have not determined the nature of the substance.

The crystalline lens capsule. The embryonic cuticula is formed as a secretion, or deposit, by the lens epithelial cells. The adult capsule is formed by accretion of layers of similar material produced by the lens epithelial cells. It undoubtedly appears first in semiliquid form and is forced under capillary pressure around and between the cortex and the previously existing capsule, with which latter it fuses. This mechanism of formation also explains the thinness of the posterior as compared with the anterior capsule. The capsule acts as a two-way selective semipermeable membrane. The nutrient and growth materials are brought in and the metabolic and break-down products of the lens are carried out through the capsule in the form of solution. There are no pores. The degree and selectivity of permeability of the capsule are very important factors in the health of the lens.

Friedenwald has proved a decrease in permeability progressing with age on a physical basis, a decreased intake of fluid through the capsule with normal output might result in the dehydrated sclerosing type of nuclear cataract. A normal intake and decreased output might produce the hydrated form of cortical cataract.

Duke-Elder has postulated an increase in permeability under certain conditions. An increased intake of fluid with normal output might result in the hydrated form while a normal intake with increased output might produce the dehydrated nuclear type.

Under normal conditions, the lens can adjust to water-content differences. If the diffusion and absorption systems are deficient then differences in water content will produce physical changes in the structure of the lens.

Exfoliation of the most superficial lamella of the anterior lens capsule is seen frequently enough to be offered as evidence that senile changes in the capsule do occur. The integrity of the capsule is most important; if it suffers, the changes in permeability are bound to affect the lens substance.

The lens epithelium. The anterior and vortex epithelial cells represent the only nucleated, reproducing individual elements in the lens. The fibers are nonnucleated elements existing as parts of the whole, somewhat like the red corpuscles of the blood. The anterior epithelial cells probably divide and move out radially to furnish cells to the vortex for the continued formation of lens fibers. The great proliferative activity of the epithelial cells can be demonstrated in tissue culture. Anatomically there is a gradual merging from the anterior cuboidal cells to the equatorial cells. The normal epithelial cells have great powers of adaptation as demonstrated by their reactions in tissue culture, but, under conditions of disease, this adaptability is impaired.

The crystalline-lens cortex. The cortex represents the softer, more recently formed lamellae of lens fibers, the most recent being outermost. The fibers contain more water and the interfibrillar diffusion spaces are more open. The relative amounts of soft cortex and hard nuclear material vary with the age and the individual tendency to sclerosis of the nucleus, whether physiological or pathological. Conditions that disturb the water-content of the lens protein in the fibers or the substances in the interfibrillar spaces may produce cortical cataract. The two-way selective permeability of the capsule, the water-binding power of the lens protein, the diffusion and absorption systems of the lens fibers, all are important in the amount and distribution of the water in the lens. The phenomena of senile cortical cataract are those of hydration of the outer layers of the lens.

The transparency of tissue. Embryonic ectoderm from which the lens is produced is semitransparent. The production of the transparent tissue of the cornea and lens requires a special dif-

ferentiation. This differentiating factor must be continued into adult life to maintain transparency. There are three, possibly more, factors responsible for lens transparency: (1) The lens protein must be of a special chemical combinatin, the nature of which is not thoroughly understood. (2) Each individual fiber must be transparent. (3) The structure of superimposed fibers and the intralenticular pressure must be such as to admit of transparency. Ultramicroscopic studies have demonstrated that lens protein, as it exists in the early embryonic lens, is in a state of solution of protein in water, whereas as it exists in the adult lens fibers, it is in a state of solution of water in protein, a solid solution. The typical Brownian movement is seen in the embryonic lens protein, where the state is that of solution of protein in water. It is necessary to add water or salt solution to the adult lens protein in order to separate the particles farther before the Brownian movement can be demonstrated.

The crystalline-lens nucleus. The crystalline-lens nucleus represents the dehydrated, hardened, older portions of the lens. The portions which in the advancing periods of life have been subcapsular are now pressed to the central zones. These may often be distinguished by their accretion boundaries and suture formations. The hardened nuclear formations resist the action of the factors which produce cortical cataract, but develop irregularities of interfaces, pressure surfaces, colorations and refraction index differences which produce nuclear haze and are part of the formation of nuclear cataract.

Types of cataract under consideration

A. Senile Nuclear Cataract.
B. Senile Cortical Cataract.
   1. Its Mechanism—Incipient Stage: (a) Production of Vacuoles or Globules; (b) Separation of Lamellae; (c) Water-splitting of Sutures; (d) Ill-defined Haze in the Cortex.
   2. The Interfibrillar Colloidal Fluid.
   3. The Intermediary Stage of Senile Cortical Opacities.
   4. Mature and Hypermature Stages of Senile Cortical Cataract.

C. Posterior Cortical Cataract—Its Mech-
D. Anterior and Posterior Subcapsular Cataracts—Their Mechanism.

Senile nuclear cataract. The process of physiologic sclerosis or hardening of the nucleus begins in the embryo and continues throughout the normal life of the lens. Pathologic sclerosis of the nucleus produces nuclear cataract. The nucleus is harder and drier than normal. This may be due to insufficient supply of water or abnormal extrusion or abstraction of water. Many other factors need to be considered but will not be discussed in detail in this paper. Much light may be had on the mechanism of nuclear cataract from the paper by Dr. Sanford Gifford presented at this meeting.

Senile cortical cataract. *Its mechanism—incipient stage.* In contrast to nuclear cataract, the phenomena of senile cortical cataract are those of hydration and intumescence. The signs of the incipient stage are:

Vacuoles or Globules (Subcapsular).
Lamellar Separation.
Splitting of the Sutures.
Ill-defined Cortical Haze.

The Production of Vacuoles or Globules. Each vacuole or globule represents a collection of colloid fluid similar in physical properties to the aqueous, which has passed along the interfibrillar spaces and has collected at the end where the capillary spaces reach the capsule. The fluid may have been extruded from the lens fibers or the lens-fiber walls may have resisted the absorption of nutrient fluid as it diffused along the interfibrillar spaces.

The Separation of the Lamellae. The lamellae are layers of lens fibers. The same factors that produce the vacuoles may cause the separation of the lamellae. Fluid extruded from the deeper layers or diffusing there under conditions of decreased absorption by the fibers will tend to separate the lamellae. The currents of diffusion of nutrient fluids must act under a certain pressure.

Water-Splitting of the Sutures. The lens sutures are formed by the abutment of the lens fibers or lamellae end to end at their junction points or lines.

These ends are merely in apposition so that excess fluid reaching the suture spaces may tend to separate or split them. The same mechanism may thus be used to explain the production of vacuoles or globules, lamellar separation, and water-splitting of the sutures. The particular feature produced depends on the area involved or its receptivity to pathologic change. It is difficult to explain the greater frequency of appearance of these features of lamellar separation and water-splitting of the sutures in the inferior nasal quadrants of the lens.

The Ill-defined Haze in the Cortex. This is most probably a cloudy swelling of the lens protein within the fibers or a lysis of the fibers with laking of the resulting fluid. In some instances this may be simply an edema, a physical change without any actual denaturation of the lens protein. The latter conception may explain the transient changes in the vision of certain patients for better or worse when the observer is unable to detect any change in the physical appearance of the vacuoles, split sutures, or separated lamellae.

The interfibrillar colloidal fluid. The water which forms the vacuoles, separates the lamellae, and splits the sutures is actually a colloid fluid. It follows certain lines of cleavage both anterior and posterior so that symmetrical areas are involved. Whether the small amount of fluid that is responsible for these phenomena is extruded from its combination with the lens protein or whether it is brought in through the capsule in excess of the normal amount is unknown. It is certain that in later stages, excess fluid is attracted through the capsule.

The intermediary stage of senile cortical opacities. After the incipient stage, the formation of a greater number of vacuoles, separated lamellae, split sutures, and diffuse haze mark the progress of cortical opacities. Morgagnian globules are grayish spherules which are developed by coagulation of the clear colloid fluid. These are found in the split sutures and lakes of broken lens material. Deposits of opaque material are made by separation of the lens protein coagulum and the attraction of inorganic and fatty materials. The changed lens protein takes up more water and the lens becomes swollen or intumescent.

The mature and hypermature stages of senile cortical cataract. The rapid death of the lens produces autolysis of the fibers and protein. Much material goes into solution and is filtered off through the lens capsule. The lens regains its normal size. The hypermature stages of the shrunken and morgagnian types are produced by further digestion, extrusion, and absorption of fluid, and also deposit of extraneous material.

Posterior cortical cataract. Its mechanism. This type begins with vacuoles or globules in the posterior cortical layers. Between and around these features develop irregular deposits of opaque material. The posterior cortical area of the lens is the most poorly nourished. The vitreous is here in contact with the posterior capsule and the ends of the youngest fibers reach the posterior capsule in this area. Toxic substances in the vitreous or faulty nutrition of the lens will affect the posterior cortical area first.

Anterior and posterior subcapsular cataract. Their mechanism. A rapidly progressive form found in complicated or toxic conditions, either local or systemic, it is not always a sign of a complicated condition, for many of these cataracts have been removed and excellent results obtained. This type begins with anterior and posterior subcapsular vacuoles. These increase in number and size and there develops a cloudy swelling of the cortex which quickly swells and disintegrates. An intumescent cataract results. This type of cataract is seen in tetany, diabetes in the young, neuro-dermatitis, detachment of the retina, and in other complicated conditions of unknown nature.

Applied chemistry in cataract

A. Deposition of Calcium.
B. Calcium Metabolism in Senile Cataract.
C. Cataract of Tetany. Its Mechanism.
D. Cataract and Diabetes.
   1. Relation of Human Aqueous Sugar to Blood Sugar.
   2. Fasting Primary Aqueous in Rela-

tion to Primary Aqueous after Food: (a) Sugar Tolerance; (b) Primary Aqueous in Relation to Blood Sugar; (c) Secondary Aqueous Sugar in Relation to Primary Aqueous and Blood Sugar.

3. Secondary Aqueous Humor in Cataract and Diabetes.
4. The Mechanism of Cataract in Diabetes.

Deposition of calcium in senile cataract. It is well known that the amount of calcium in the lens is greatly increased in cases of senile cataract. Salit found no increase in the early stages of incipient cataract. The deposition is most probably a reaction secondary to (1) very slow tissue death, dependent on nutritional deficiency; (2) degeneration of the lens protein with lipoid and other by-products; (3) local concentration of calcium by adsorption to the large molecules of the lipoids; and (4) deposition of the calcium by final change in the hydrogen-ion concentration towards the alkaline side.

Calcium metabolism of patients with senile cataract. The serum calcium level of a series of patients with senile cataract was normal. An elaborate investigation of the endogenous calcium metabolism of these cases proved that they absorbed, utilized, and excreted their calcium normally. There was no indication of parathyroid or calcium deficiency in these cases. Therefore, senile cataract cannot be caused by calcium deficiency or excess.

Cataract of tetany. Its mechanism. Disturbances of calcium metabolism with calcium deficiency, absorption, and use is the cause of tetany in infants and in postoperative cases where the parathyroids in whole or in great part have been removed. The widespread knowledge concerning this and the measures that are taken to prevent tetany in infants and in post-thyroidectomy cases, both prophylactic and therapeutic, have resulted in a great decrease of these cases.

In tetany, the blood-serum calcium is reduced below normal. This implies a reduction in the aqueous calcium. The lens normally contains an extremely small amount of calcium but this is necessary. In two series of experiments, Hess found the lens calcium reduced in his tetany animals. This reduction is sufficient to disturb the equilibrium in the inorganic elements in the lens and to cause changes in the sensitive colloidal solution of the lens protein. The convulsions may cause some other change in the aqueous as cataract in tetany is always associated with convulsions.

Cataract and diabetes. A study of cataracts in diabetics demonstrated that the greatest percentage is of the senile cortical type, occurring on the average ten years earlier than in the nondiabetic persons. The rapidly developing cataract characteristic of diabetes is found rarely, usually in adolescent patients. The severity of the disease is not a significant factor, as the cataracts occur with equal frequency in the mild and in the severe cases, but the greater the duration of the disease, the relatively more frequent are the cataracts.

Retinal and general vascular sclerosis with hypertension is frequent in diabetes. In cases in which cataract developed, retinitis was more frequent than in those with clear lenses. Retinitis, however, does not necessarily accompany cataract. The height to which the blood sugar may rise does not determine cataract, as the lenses in certain patients have remarkable powers of adaptation.

The relation of human aqueous sugar to blood sugar. To learn of the importance of the sugar level alone in the development of cataract in diabetes, the sugar content of the primary aqueous in relation to the sugar content of the blood was studied in patients in the afternoon out-patient department. The primary aqueous considered is the humor which normally fills the anterior chamber.

Patients	Number	Primary Aqueous Sugar	Blood Sugar	Ratio
Nondiabetics—Cataract	25	103	120	0.82
Diabetics—Cataract	23	124	146	0.83

The fasting primary aqueous in relation to the primary aqueous after food. Study of Thirteen Cases of Varying Sugar Tolerance. The fasting sugar showed an average deficit of 20 percent when compared with the fasting blood. The rise in comparing the primary aqueous of one eye with the primary aqueous of the other eye was 25 percent compared with the rise of 88 percent in the blood-sugar values. During the second hour, when the nondiabetic blood curve was falling, the aqueous continued to rise. The diabetic cases showed a continued rise in aqueous sugar even into the third hour, as the blood-sugar rise continued into this period.

The Human Primary Aqueous in Relation to the Blood Sugar. In the patients with normal sugar metabolism, the aqueous sugar does not rise to a sufficient height to disturb the lens. Transient hyperglycaemia cannot be held responsible for cataract development in elderly nondiabetics as the blood sugar has dropped to the fasting level before the slowly diffusing sugar has had time to affect the sugar level of the aqueous very much. If the elevation of the blood sugar be prolonged, then the aqueous tends to rise and to equilibrate with it. These cases are diabetics and should be considered and treated as such. In these the height of the aqueous sugar is undoubtedly one of the factors concerned in the formation of cataract.

The Human Secondary Aqueous Sugar in Relation to the Primary Aqueous and Blood Sugar. The secondary aqueous is that humor which forms immediately after the primary aqueous has been removed. It is formed by rapid transudation from the capillary plasma. There is increased permeability of the semipermeable membrane of the ciliary epithelium and dilatation of the capillaries of the ciliary body. In the fasting state, the sugar content approximates that of the primary aqueous, whereas after carbohydrate food intake the sugar content of the secondary aqueous tends to rise rapidly above that of the primary aqueous of the same eye and to approximate that of the blood.

The secondary aqueous humor in cases of cataract and diabetes. Most of these cases showed a decreased permeability of the ciliary membrane or decreased dilatability of the capillaries, if one is correct in judging of the results obtained. These conditions may be responsible for the faulty nutrition of the lens. In this manner, the decrease in permeability in diabetics may be a potent factor in the cause of cataract. Some of the cases showed a marked difference in the behavior of the two eyes in the same individual. This may explain the difference in the development of cataract in the two eyes.

The mechanism of cataract in diabetes. When the blood sugar rises, an adjustment must be made to keep the osmotic pressure of the blood normal. The salts of the blood are excreted. This produces a more dilute plasma as the salts which were excreted had more effect upon the osmotic tension than did the sugar which caused their displacement. The effect upon the aqueous is that of dilution. This osmotically more dilute aqueous is taken up more freely by the lens, the protein of which has under certain abnormal conditions a greater affinity for water. The lens swells and lenticular myopia is produced. Not all diabetics' lenses behave in this manner, nor do the individuals who are affected always respond to fluctuations in the sugar content of their blood. There are other factors that influence the behavior of their crystalline lenses.

If the process of hydration or waterlogging of the lens be more severe than that which the lens can adapt itself to, then droplets of fluid are seen beneath the lens capsule, the separation of the lens fibers develops, the splitting of the sutures occurs, and the fibers may be burst and laked to produce the cloudy swelling of the cortex. These features form the cataract. Edema of the ciliary and iris epithelia is frequently seen in diabetes. It is possible that recovery from these conditions may occur in certain cases. But when denaturation and coagulation of the lens protein have occurred and inorganic and fatty deposits made, recovery is not possible.

Other factors that may account for

the formation of cataract in diabetes are (1) the vicious influence of diabetes upon the whole organism, (2) vascular sclerosis, (3) excess acid formation, (4) disturbances of fat metabolism, (5) disturbances of permeability of the selective semipermeable membranes of the ciliary epithelium and lens capsules. The sugar alone in the aqueous, even though elevated, does not account for the formation of cataract in diabetes. Some of the above or an unknown factor may explain the development of cataract in diabetes.

A colloidal solution, such as the lens protein, needs a certain equilibrium of the inorganic ions to maintain it in solution. In diabetes as the blood sugar goes up, the inorganic salts including sodium chloride are in part excreted to maintain the osmotic equivalents of the blood. This means less of the necessary sodium and chloride in the aqueous and lens. If the amount of sodium and chloride is reduced below the necessary minimum for the particular colloidal solution, any globulin will be precipitated out. Alpha and beta crystallins are both globulins.

Hypothesis

One hypothesis may be permitted in this paper. The various phenomena expressed in the mechanism of senile cataract are those of disturbances of permeability. The tissues affected in the eye are the ciliary-body blood vessels and tissues, including the selective semipermeable ciliary epithelial membrane, the lens capsule, the lens fibers and the interfibrillar diffusion spaces.

The cause of these disturbances in permeability must be sought more deeply. They may be chemical, physical, or dependent on metabolic changes in the general system. At the present time knowledge concerning these factors is incomplete. Many theories might be elaborated, but none will be found to cover all the cases satisfactorily.

Summary

The mechanism or mode of production of various features of the different types of senile cataract has been analyzed. The application of certain facts and principles of the anatomy and pathology of the lens to cataract has been made. The important conditions of tetany and diabetes and the relation of disturbances of calcium and carbohydrate metabolism to cataract have been studied and certain inferences drawn in regard to senile cataract.

Conclusions

The most striking feature found in considering the phenomena of the mechanism of senile cataract is that of disturbance of permeability: 1. of the ciliary epithelial membrane, 2. of the crystalline lens capsule, 3. of the interfibrillar diffusion spaces of the lens, and 4. of the lens fibers themselves. The causes of these changes in permeability, diffusion, absorption and extrusion of fluid may be numerous and varied. More fundamental and clinical research is necessary.

Acknowledgments are gratefully made to Professor John M. Wheeler and to the Fellows of the American Academy of Ophthalmology and Otolaryngology.

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The relation of disturbances of carbohydrate metabolism to cataract. Amer. Acad. Ophth. and Oto-Laryng., 1932.

Discussion: Dr. Alan C. Woods: May I ask Dr. Kirby if changes in refraction of myopia are entirely due to the water-logging of the lens to the exclusion of changes of refractory aqueous and vitreous with a rapidly rising blood sugar?

Dr. Kirby: I know Dr. Adler has very beautifully demonstrated the changes in the index of refraction of the aqueous and vitreous that do occur. I think others have pointed out that the amount of change of refraction that takes place in the eyes of certain diabetics cannot be satisfactorily explained simply by the difference in the index of refraction of the aqueous as compared with that of the lens and vitreous. The phenomena observed in the eyes of diabetics justify the idea that in certain cases at least we do have swelling of the lens and changes in the curvature of the capsule to account for the myopia.

Duke-Elder summarized the situation by stating that in the course of the disease with high or increasing sugar, myopia tends to occur, while with decreasing sugar after dietary or insulin treatment, hypermetropia tends to occur. It does not happen in every diabetic case and is quite variable even in the same individual. The site of the change in focus is most probably the lens, the capsule and substance of which are freely permeable to dextrose. The fleeting character of the changes does not disprove the theory that dextrose is the responsible factor as it diffuses in and out of the lens quite freely. In this connection one must also take into account the products of dextrose catabolism in the lens and their effect on the water-binding capacity of the lens protein. Another hypothesis is that the changes in refraction are due to a change in the index of refraction of the media depending upon the variation in sugar concentration. If the change is regarded as affecting all the media, then the necessary conditions are impossible, but Adler has postulated a differential change in concentration in the aqueous as compared to the vitreous. The sugar concentration of the vitreous is considerably lower than that of the aqueous and since the rate of its changes in concentrations also lags behind that of the aqueous, a relatively small change in either would account for considerable ametropia. Friedenwald could not agree with this hypothesis since the allowable differences in dextrose content of aqueous and vitreous would not account for more than a fraction of a diopter in refraction. Both Friedenwald and Duke-Elder have reasoned that the fluid intake on part of the lens is more effective in changing the refraction when the nucleus of the lens is well developed and while there is still sufficient pliable cortex to respond to the hydropic change. Hence these changes are seen more often in diabetics at ages between forty and sixty years. In connection with these theories one must again consider the effect of an acidotic condition on the water-binding capacity of the protein as well as the effect of changes in certain cellular constituents, such as a shift between monovalent and divalent cations, or in the lipide and sterol fractions, on cellular permeability. Severe dietary restrictions have been considered as one of the causes of changes in index of refraction. Jensen reports a case of transitory impairment in refraction due to a strict reducing diet in a nondiabetic woman of sixty-five. In this case, change in refraction set in three times and each time after an essential change in diet.

Changes in refraction may be accounted for even though the sugar in the aqueous does not rise to any degree. In a number of our patients we found that the aqueous sugar did not follow the blood sugar. In fact, there was often a marked difference. In all the cases examined there was a tendency of the aqueous sugar to approximate that of the blood in the fasting state. In the diabetics the dextrose concentration of the aqueous was often considerably elevated. If the refraction of the lens varied directly with the sugar content of the fluids surrounding it, one would expect a hyperopic change in these patients which, however, is not always present.

Dr. Woods: I quite agree with Dr. Kirby and I further ask him if he knows

any swelling of the lens that does occur under the influence of a rise of blood sugar.

Dr. Kirby: I think the best definite evidence is the fact that we have the appearance of globules, vacuoles, and the separation of the sutures and the lamellae in the extreme cases. I do not believe we can, as you know, Dr. Woods, bring out any physical evidence or any practical evidence of this change, but considering all the different explanations, I think you will agree that this is the more practical.

Chairman Parker: Do you agree?

Dr. Woods: I agree.

Have you experimented by placing lenses in sugar solution?

Dr. Kirby: No, that necessarily does not cover all the features you have in diabetes. You do not have the semipermeable membranes of the ciliary body, you do not have the circulation of the blood and the changes that take place in the contents of the blood. You will agree that you need a more complex set-up for your experiment than simply placing the lens in sugar solution.

THE BIOCHEMISTRY OF THE LENS

II. A study of cataracta nigra and cataracta brunescens

SANFORD R. GIFFORD, M.D., AND IRVING PUNTENNY,* M.A.
CHICAGO

The authors find no sharp line between typical brown cataract and ordinary nuclear sclerosis. No free tyrosine or tyrosinase was found in normal or cataractous lenses, but a ferment capable of oxidizing dopa to melanin occurs in the cataractous lens, greater in quantity in the brown type and in nuclear sclerosis. From the Department of Ophthalmology, Northwestern University Medical School. Read before the Association for Research in Ophthalmology, in Milwaukee, June 13, 1933.

The purpose of this paper is to summarize our present knowledge of this particular type of cataract, to point out in what respects it differs from other types of lens change, and to report some experimental work which seems to throw light on the origin of the color that is its best-known characteristic.

The term "black cataract," or "cataracta nigra" proposed by Wenzel in 1788 should probably be replaced by that of "brown cataract" or "cataracta brunescens." The characteristic color is brown; in only a few cases is it dark enough to be almost black. All degrees of color occur between that of almost black lenses and of those which show a yellowish tint with the ophthalmoscope but which, on slitlamp examination, show the same mahogany brown, becoming densest near the center of the lens, which Vogt[1] has described for cataracta nigra. Cases in which the brown is only faint, are much more common than the extreme types; in fact, if lenses are examined routinely with the slitlamp, they are seen to be quite common in persons past the age of 60 years.

Clinically we know that brown cataract is especially common in cases of myopia and that it progresses very slowly, often requiring 10 to 12 years to reach a stage requiring operation. It increases the myopia by increasing the refractive index of the lens, and at the time of cataract operation the nucleus is invariably found to be very large and hard. This type of cataract has a bad reputation with some operators, and Jess[2] mentions the frequency of complications after its removal. Rollet and Bussy[3] saw iridocyclitis develop after operation on both eyes of one case, resulting in almost complete loss of vision, and obtained good results in only 15 of their 23 cases. It seems probable that such complications are simply those associated with high myopia, accompanied, as it is, with liquefaction of the vitreous and commonly by loss of vitreous at operation. Others, including the authors, have not seen such complications more frequently than with other types of cataract in myopic cases. A factor of advantage is that the large nucleus includes the greater part of the lens so that little cortex is left after its removal. It is, therefore, a type of cataract which may be operated upon successfully by the extracapsular method without waiting for maturity. Maturity, in the ordinary sense of the word, almost never occurs in brown cataract. The nucleus becomes denser and includes more and more of the lens, but the change is exceedingly slow, and a narrow zone of clear cortex may usually be seen with the slitlamp when vision is so poor as to require operation. It is the authors' opinion that there is no sharp line between typical brown cataract and ordinary nuclear sclerosis. When the latter is at all advanced a distinct yellowish color is seen with the ophthalmoscope, and the slitlamp usually shows a certain degree of reddish brown in the nucleus. In certain cases the brown color becomes deeper and interferes much more seriously with vision. In other cases water-fissures and other forms of opacity occur in the cortex and lead to the picture of mature senile cataract. It is not uncommon at operation to see emerge from a mass of soft opaque cortex a hard brown nucleus.

* Ward Fellow in Ophthalmology.

This similarity between nuclear sclerosis and cataracta nigra was recognized in 1876 by Becker[4], one of the old masters of cataract-research. He stated that there were all stages between hard senile cataract or what we call nuclear sclerosis, and cataracta nigra. He examined three lenses with cataracta nigra removed in the capsule and found that the whole lens was converted into a hard nucleus with no separation between the fibers. Hess[5] in 1905 agreed with him and believed that the difference in color between the normal senile lens and cataracta nigra was not an essential one, but only one of degree. Vogt has given the subject careful consideration and his conclusions are much the same. He describes three stages in the gradual change from the yellow of the normal senile lens, to the yellowish red or brown which occurs in certain cases. In the second stage most of the light except the red rays is absorbed, so that the nucleus and all of the lens behind it appear red in the slitlamp beam. In the third stage, even the red rays are absorbed and the posterior half of the lens appears black. The posterior cortex is clear, but is not seen through the opaque nucleus. The gradations of color seen in the same lens are evidence to him that no different coloring matters are present but only varying amounts of the same color. He has seen a number of cases with yellow nuclear sclerosis in one eye and cataracta brunescens in the other. He points out that another type of cataract, the so-called lens with double focus, is a forerunner of cataracta brunescens. Here the most dense sclerosis is confined to the embryonal nucleus, giving it a brown color, and the marked difference in refractive index between this and the surrounding clear cortex causes the central portion of the pupil to be highly myopic, while peripheral portions are emmetropic or even hyperopic.

As might be expected from these clinical differences, there are certain differences in biochemical behavior which distinguish nuclear sclerosis and cataracta brunescens from cortical cataract. Jess and others have shown that in cortical cataract the soluble lens proteins, especially beta crystallin, are lost from the lens and replaced by water. There is a relative increase in the insoluble nitrogenous constituents, the albumoid of the German authors. The inorganic constituents, especially calcium, increase, as shown by Salit[38] but this may be considered a secondary change, comparable to the deposition of calcium in necrotic tissue or in scars. This loss of soluble proteins is a definite departure from what occurs in the normal growth of the lens, and is, in fact, the most definite evidence of a pathologic change in cataract as opposed to the normal changes during growth of the clear lens. In the clear lens, as Jess has shown, there is an increase in the soluble proteins, alpha and beta crystallin, and a relative loss in water.

This is what occurs in nuclear sclerosis and also in cataracta brunescens. Kubik[6] estimated the solid constituents of a large number of cataractous lenses by weighing them after removal and then after all the water was removed by desiccation. He found that for clear lenses the average percentage of dry to total weight was 32.06. In immature cataract (type not specified) it was 28.75 percent, for mature cortical cataract 25.5 and for hypermature cortical cataract 22.2. In nuclear cataract, on the other hand, it was 32.10 or greater than that found in the clear lenses. (Only three clear lenses were available, which may account for the fact that the dry weight to total weight was higher in a group of incipient cataracts, 33.78 percent, than in the clear lenses.) There were a number of exceptions, but the number of lenses in each group was large, from 12 to 96, so that the figures for these groups must be considered significant and as showing a loss of solid constituents in cortical cataract and a slight increase in the nuclear type. Kubik gives no figures for brown cataract, but presumably some lenses of this type were included with the nuclear cataracts.

The change in the lens chemistry in cortical cataract, a hydrolysis of the lens proteins which are replaced by water, was pointed out in a previous

paper[7]. In nuclear sclerosis and cataracta brunescens, on the other hand, an increase of solids and loss of water continues to a more marked degree than in the normal senile lens. Nuclear sclerosis, as Vogt has suggested, is thus a protective mechanism against liquefaction of the lens, and cataracta brunescens, representing the advanced stage of sclerosis, may be considered the result of normal processes allowed to go on without the intervention of cortical changes or death of the lens fibers.

The origin of the color in cataracta brunescens has been explained in various ways. An early theory was that of an absorption of blood-pigment by the lens. Moauro (quoted by Hess), in 10 lenses, reported the presence of hematin, hematoidin, or melanin. Hess, however, found none in material from two typical cases, by chemical tests, and negative results were later reported by Burdon-Cooper[8] 1914, Cirincione (quoted by Busacca), Speciale-Cirincione[9], Busacca[10], Carmi[11], Rollet and Bussy[3], Magnasco[12], Neuschuler[13], Sliusenkov[14]. Spectroscopic analyses by Bucklers[15], Elschnig and von Zeynek[16], Mawas[17] and Sliusenkov were also negative for blood pigment. Herzfeld[18] in a case of Vogt's found no hematoidin or hematin but traces of haemochrome and bilirubin, on spectral analysis. Hemochrome it must be remembered, is the iron-containing substance which is probably present in minute traces in every living tissue having only remotely an origin from the blood. It was found in other types of cataract and Vogt did not believe, apparently, that it accounted for the brown color of his lenses. Rollet and Bussy concluded that earlier findings of blood pigment were only in cases complicated by hemorrhages with breaks in the lens capsule, and that it is absent in typical cataracta brunescens.

Another explanation was that offered by Alt[19] in 1900. He examined the lens histologically in a case of cataracta nigra and found what were apparently granules of pigment deposited around the nucleus. He considered them products of degenerated pigment epithelium, in which case they must have penetrated the lens from without. To this Hess objected that such a preformed product could hardly penetrate the lens capsule which was apparently intact in such cases.

Negative chemical tests or spectroscopic findings for melanin in cataracta brunescens were reported by Carmi, Rollet and Bussy, Speciale-Cirincione, Mawas, Corrado[20], Busacca, Herzfeld, and Cirincione (quoted by Busacca). Sliusenkov found negative chemical tests for melanin, but on spectroscopic analysis absorption bands suggesting its presence. Takeishi[21] found by microchemical methods refractile granules which were decolorized by active oxidizing agents and which stained by Mallory's method. He considered them to contain a substance akin to melanin. It seems that we must agree with Hess that the absorption of preformed melanin through the intact lens capsule is impossible, especially in view of the findings of Friedenwald[22] and the authors, on the permeability of the lens capsule. These showed that globulin, for example, did not dialyze through the normal capsule and that the capsule in senile catract shows no increase in permeability. Melanin, a more complex substance than globulin, could certainly not dialyze through the intact capsule. The possibility that melanin or a similar substance may be formed within the lens itself will be discussed later.

Most of the authors quoted above, who found no evidence of melanin or blood-pigment in the lens, concluded that the color in cataracta brunescens was a physical phenomenon due to the increased refractive index of the highly sclerotic lens.

Busacca studied the fresh, unstained lens fibers in a characteristic case. The cortex was very thin and showed hydropic degeneration next the capsule. In the nucleus, the fibers themselves were brownish in color, containing no droplets or vacuoles. The individual fibers contained fine interlacing threads of high refractive index. Fat stains showed some droplets of lipoid material. Busacca concludes that the color is not due to lipoids or any form of

pigment but to the peculiar refractivity of the filaments composing the lens fibers. Others who have arrived at a similar explanation of the color by exclusion are Mawas, Magnasco, Carmi, Cirincione and Neuschuler. Rollet and Bussy offered as an objection to this the lens accounted for the apparent equally sclerotic, show no such dark color. Speciale-Cirincione obtained a brown solution by dissolving lens substance but since tests for melanin were negative, believed the physical state of the lens accounted for the apparent color. Elschnig and von Zeynek, however, who obtained a similar colored solution on warming the lens substance with 3-percent potassium hydrate thought that this demonstration of the presence of a colored substance excluded the theory of a purely physical cause. They mention the fact that melanin is not a substance of definitely known chemical structure and that spectral analyses could not exclude the melanin group. They believed that several components of the lens protein can show such a color under certain conditions, and that such substances must account for the color of black cataract.

The idea that melanin or allied substances might originate in the lens itself by chemical changes in the lens protein may well arouse new interest in view of recent studies of the origin of melanin. Von Szily[23] in 1911 showed histologically that pigment developed in cells of the eye and other tissues from unpigmented granules of what were apparently mitochondria. He suggested the possible change of a colorless premelanin into melanin through the influence of a ferment, possibly tyrosinase, circulating in the blood. Masson[24] and associates, in 1913, showed that by silver-impregnation of tissues melanin could be revealed in tissues previously colorless. Redslob[25] showed this substance in the normal bulbar conjunctiva of Europeans. It was absent from the avascular cornea but present in the basal epithelium of vascularized pathological cornea. Winternitz[26] in extracts of the pig's uveal tract and in certain other pigmented tissues found a substance which caused the extract to become black when tyrosine was added. The substance became inactive after heating and behaved in other ways like an enzyme or oxydase. It was preserved for long periods after drying. Bloch[27] while he failed to find such a substance in uveal tissue, made an important step in our knowledge of pigment-genesis. In 1916 he isolated a colorless substance, dioxyphenylalanin, which changed to melanin on exposure to extracts of the skin and other ectodermal structures.

This colorless substance, the name of which Bloch kindly suggested be shortened to "dopa" is closely allied in structure to tyrosine, and both are precursors of melanin. The substance is present in ectodermal structures and, according to Bloch, only in these. In the presence of such tissues, dopa turns to melanin and he considered this change as due to a ferment, dopa-oxydase, present in the tissues. The importance of these findings for the genesis of pigment in the skin and in certain tumors has been recognized by dermatologists and pathologists.

The fact that tyrosine itself turns black in the presence of an oxydase was known before, and Gatti[28] in 1904, explained the brown color of naphthalene cataracts as due to oxidized tyrosine. He found that the lenses and vitreous of animals fed naphthalene became yellowish red, turning to brown on exposure to air. This color faded when lenses were placed in a vacuum, and reappeared on reexposure to air. He tested the serum, vitreous and lenses of normal and naphthalenized animals for the presence of an oxydase which could oxidize tyrosine. He found some evidence of an increase in oxydase in the ocular tissues of the naphthalenized animals, and concluded that such an oxydase was freed from the tissues by naphthalene and was responsible for the brown color of these lenses. He admitted, however, that the ferment was not tyrosinase, since the tissues failed to turn darker on addition of tyrosine. From the details of his report it would not seem that such conclusions are justified and it is especially difficult to conceive the process as a tyrosine re-

action if tyrosinase were not present.

Nicati[29] suggested that the amber discoloration of the senile lens, like the darkening of finger nails and dental enamel, may be due to the oxidation of tyrosine, and that it might go on in certain cases to the stage of cataracta nigra. Michaïl and Vancea[30] accepted Gatti's conclusions with regard to the color of naphthalene cataract, and reported that they could delay or even prevent the appearance of the color by administration of insulin which they found inhibits disintegration of the lens protein. In criticism of this it may be said from the authors' experience that the color varies greatly in individual animals and is absent in many with complete naphthalene cataract. This work and that of Gatti has, of course, no necessary connection with human cataracta brunescens, though suggesting interesting analogies.

Gatti's theory was, in fact, accepted by Rollet and Bussy, Corrado, and others, as an explanation of the color in cataracta brunescens. Burdon-Cooper observed crystals of tyrosine and leucine in the aqueous after needling the clear lens, and also in cases of senile cataract. He found that the cortex of ordinary senile cataract, when treated with a weak acid and exposed to light, developed a brown color like that of cataracta brunescens. This did not occur if the lens substance was first boiled, indicating that the presence of an enzyme was necessary. He believed this to be tyrosinase, which acts on the tyrosine freed by the hydrolysis of lens protein that occurs in senile cataract, and suggested this process as offering the best explanation of the color in nuclear sclerosis and cataracta nigra. Vogt, while not specifying a tyrosine-tyrosinase reaction, thinks the phenomena of cataracta brunescens are best explained by a change in the lens protein itself.

Reports on the occurrence of tyrosine in the lens illustrate the insufficiency of chemical methods often applied to studies of this kind. Magnasco, Carmi, Sliusenkov, and Neuschuler found negative tests for tyrosine in black cataract. Rollet and Bussy found tyrosine present but neither they nor the previously mentioned observers were apparently aware of the fact that tyrosine, combined in the protein molecule, is a normal constituent of the lens, composing about 4 percent of the lens protein, according to Jess. He suggests that this high tyrosine content may be a factor in the genesis of cataracta brunescens. On account of the difficulty of working with such small quantities of material, no estimates seem to have been made of the amount of tyrosine in brown cataract, or, indeed, in senile cataract, as compared with that in the normal lens. Tests for free tyrosine in brown cataract have not been made and the only satisfactory test would seem to be the reaction with tyrosinase to be described later. Labbé and Lavagna[31], however, have estimated the amino nitrogen in clear and cataractous lenses of horses, and found in cataractous lenses five times as much as that in the normal lens. This suggests that an increased amount of tyrosine is to be expected as part of the proteolytic processes occurring in ordinary cataract. Occasional reports, such as that of Braun[32], of the occurrence of tyrosine crystals in the otherwise clear lens do not add clearness to our conception of the conditions under which this might occur.

It seemed desirable to repeat some of the previous work which might throw light on the origin of the color in cataracta brunescens. Aqueous extracts of brown cataract after pulverization gave a clear filtrate and a brownish residue of powder. On warming with 3 percent sodium hydrate, however, a yellowish-brown solution was obtained, as Elschnig and von Zeynek had observed. This remained stable for long periods. With some brown lenses, it was possible to dissolve the brown coloring matter with cold 3 percent NaOH. In a personal communication, Gordon Walls[33] states that he was unable to dissolve the pigment of brown and black human cataracts in cold 2 percent KOH, which dissolved freely the yellow pigment that is normal in squirrel lenses, which they called lenti-flavin. The fact that such a colored solution was ob-

tained by Elschnig and von Zeynek and ourselves seems positive evidence that a colored substance is actually present in such lenses. Hence the widely held theory that the color is due to the physical structure of the lens seems untenable.

tyrosinase. Normal lenses, cortical cataracts and brown cataracts, however, when immersed in a solution of tyrosinase for 48 hours, showed no change in color (table 1). Free tyrosine is necessary for the reaction and it is apparent that no free tyrosine was present

Table 1

EFFECT OF TYROSINASE ON THE NORMAL AND CATARACTOUS LENS

Test No.		Results
1	Control No. 1. (Dist. Water and Tyrosinase)	No Reaction
2	Control No. 2. (Tyrosinase and Tyrosine)	Black precipitate
3	2 c.c. of hydrolyzed Lens Solution and Tyrosinase	Black precipitate
4	2 c.c. of hydrolyzed Lens Solution and Tyrosine	No Reaction
5	5 light human cataracts 10 brown human cataracts } in individual tubes containing 10 c.c. .05% Na_2CO_3+5 mg. Tyrosine	No change in cortex and nucleus
6	10 brown human cataracts 5 light human cortical cataracts } in individual tubes containing 10 c.c. .05% Na_2CO_3+2 c.c. of Tyrosinase Sol.	No change in cortex and nucleus

The color of such solutions did not fade when air was removed or replaced by CO_2, and hence is not due to a reversible tyrosine-tyrosinase reaction. It was also found that the brown of naphthalene cataracts did not fade, as Gatti had reported, when excluded from air.

The suggestions previously referred to that tyrosine might be oxidized in the lens to form a pigment led us to determine the presence of tyrosinase or free tyrosine in the lens.

Tyrosinase was prepared according to the method of Raper and Wormall[34]. This was made free of tyrosine by repeated precipitation with ammonium sulphate so that it remained clear during the experiments. This reagent gave a black precipitate on addition of tyrosine. Dried normal beef lenses were hydrolyzed with 20-percent HCl for 12 hours. In a relatively small number of determinations this material was found by the method of Folin and Denis[35] to contain 60 mg. of tyrosine per gram or 6 percent of dried substance. Addition of solutions of this material neutralized to pH 8 gave a black precipitate with in these 15 lenses. This seems to exclude the possibility that free tyrosine could accumulate in the lens during life in sufficient amounts to account for the color of brown cataract. A small number of rabbit lenses with naphthalene cataract were tested in the same way with tyrosinase, but there was no change in color of the solution or lenses, so evidently no free tyrosine was present.

This reaction only occurs in neutral or slightly alkaline solutions (best at pH 8) so it is difficult to see how Burdon-Cooper's observation that cataractous material turned brown when acidified and exposed to air can be explained as due to a tyrosine-tyrosinase reaction.

Fifteen other cataractous lenses were immersed in a solution of tyrosine of the same reaction. There was no change in color after 48 hours. This seems to exclude the presence of tyrosinase in these lenses.

The recognition that dopa-oxydase is the constituent of ectodermal structures responsible for pigment-genesis previously referred to suggested the de-

sirability of investigating its presence in the lens.

Normal rabbit and dog lenses, and human cataractous lenses, including brown cataracts and lenses with nuclear sclerosis, were immersed in 10 c.c. of .05-percent sodium carbonate solution to which 3 to 5 mg. of dopa* was added (table 2).

In the tubes in which the air was replaced by Co_2 the solution remained clear. In only 3 of the 15 cataractous lenses tested under these conditions was there any change in color, a darkening of the cortex after 24 hours, the nucleus remaining the same. In tubes containing air, the solution turned dark after 24 hours, as did control solutions of dopa in the presence of air. Groups of 10 normal dog and 10 rabbit lenses showed no change in color after 60 hours in this solution. Another group of 2 rabbit lenses showed slight darkening of the cortex after 60 hours. One group of 16 fresh human cortical cataracts showed no change after 48 hours. Another group of 4 showed slight darkening of the cortex. One group of 2 brown cataracts and cataracts with nuclear sclerosis showed only slight darkening of the cortex while another group of 26 similar lenses showed more marked darkening of the cortex. The nuclei remained the same in all. The reaction varied considerably with individual lenses, some lenses turning almost black, while others showed only slight change. In general, the darker the nucleus, the greater was the change in the previously uncolored cortex.

The lenses of a rabbit with naphthalene cataract were tested in the same way. The cataract was grey and almost completely opaque. It was found to turn almost black in the solution of dopa while remaining unchanged in the control solution. Figure 1 shows this

Table 2

EFFECT OF DOPA ON NORMAL AND CATARACTOUS LENSES

Quantity of Lenses	Type	Solution used	Quantity of Dopa used	Time	Reaction in presence of	Results		
						Cortex	Nucleus	Solution
12	brown human cataracts	10 c.c. .05% Na_2CO_3	3–5 mg.	24 hours	CO_2	No Change	No Change	Remained Clear
3	brown human cataracts	"	"	24 hours	CO_2	Some Darkening	"	"
26	brown human cataracts	"	"	48 hours	Air	Some Darkening	"	Turned Dark
20	brown human cataracts	"	"	48 hours	"	Little if any change	"	"
16	fresh human light cataracts	"	"	48 hours	"	No Change	"	"
4	fresh human light cataracts	"	"	48 hours	"	Some Darkening	"	"
10	fresh dog lenses	"	"	60 hours	"	No Change	"	"
10	fresh rabbit lenses	"	"	60 hours	"	No Change	"	"
2	fresh rabbit lenses	"	"	60 hours	"	Very little Darkening	"	"

* Obtained of Schuchardt (Berlin).

change in comparison with a clear rabbit lens treated with dopa.

These reactions certainly suggested the presence in cataractous lenses of a ferment which reacts with dopa. An objection to the method, however, is the time required for the penetration of fluids into the lens, during which time the solution itself has turned dark. To avoid this, sections of normal and cataractous lenses were treated with dopa according to the technic described by Laidlaw and Blackberg[36]. Lenses were brought to the laboratory as soon after operation as possible, usually within 3 hours, in dry stoppered tubes. The reaction seems to take place when lenses have been preserved in this way 24 to 48 hours and possibly longer. Frozen sections, 70 to 100 microns thick, are placed in a 1:1000 solution of dopa at

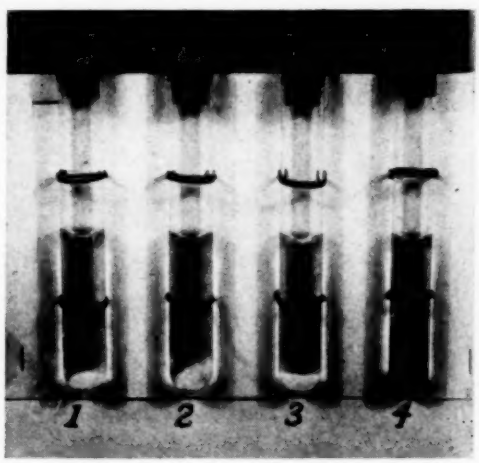

Fig. 1 (Gifford and Puntenny). Effects of dopa on normal lens and naphthalene cataract. Tube No. 1 contains half of a normal rabbit lens in 10 c.c. of 0.05 percent Na_2CO_3. Tube No. 2 contains the other half of the normal rabbit lens in 3 mg. dopa plus 10 c.c. of .05 percent NA_2CO_3. Tube No. 3 contains half of a naphthalene cataract (rabbit) in 10 c.c. of .05 percent NA_2CO_3. Tube No. 4 contains the other half of a naphthalene cataract (rabbit) in 10 c.c. of .05 percent Na_2CO_3 plus 3 mg. of dopa.

37°C. The solution is buffered to pH 7.4 by adding 2 c.c. of 1.1-percent Na_2HPO_4 and 6 c.c. of .9-percent KH_2PO_4 to 25 c.c. of 1:1000 dopa solution. The solution is renewed after ½ hour and sections are examined at ½-hour intervals for 2 to 3 hours, after which time the solution itself has turned somewhat dark. Sections of normal rabbit lens left in dopa for ½ to 1 hour showed no appreciable change in color. After 1½ hours a slightly grayish color appeared, which was somewhat darker after 2½ hours.

Lenses with senile cataract of various types varied considerably in their reaction. In all cataractous lenses a certain amount of color was present after 1 to 1½ hours, when the solution was still quite clear. In those with fairly yellow nuclei the color was darker and appeared after ½ to 1 hour. One very dark lens, an extreme type of cataracta brunescens, showed the greatest change in color (see figure 2). The color of the sections before immersion in dopa was distinctly yellow, but after ½ hour this became brown and after 1½ and 2 hours the color was a dark mahogany brown. Sections of these sclerotic lenses showed the colored material in two locations. In sections removed after ½ to 1 hour, it was confined almost entirely to the lines of separation between the homogeneous sclerotic fibers, which, on cutting down the light, were of a mahogany-brown color. In some places, especially near the center of the lens a layer of fine black granules could be seen between the fibers. This was especially marked in the brownest cataract referred to above, but was also present in the nuclear portion of the other sclerotic lenses. These lines of separation seem to represent the fine refractile fibrils described by Busacca. It seems likely that these fibrils are the condensed sheaths of the lens fibers, many of which seem fused together in lenses of this type. In sections left 1½ to 2 hours and longer, staining of the second type appeared. This was a diffuse staining of the lens fibers themselves in which very fine granules could be made out (fig. 3). Since this appeared especially when the solution had become dark it may perhaps be considered as due to simple absorption of staining matter from such solutions. It was however, much darker in the brownest lenses. Sections of the brown

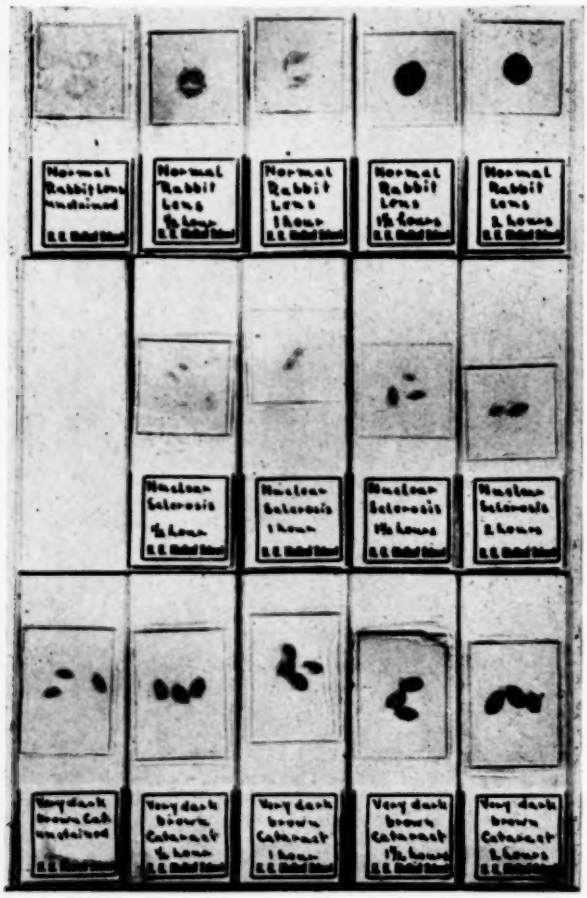

Fig. 2 (Gifford and Puntenny). The reaction of normal rabbit lens, nuclear-sclerosis lens, and brown-cataract lens to dopa solution.

lenses immersed whole in dopa in the previous experiments showed staining of these two types.

In the normal lenses this type of staining occurred after 2 hours but not the type in which the interfibrillar substance became brown. No black granules appeared in the normal lenses.

As in the experiments with whole lenses, a clear-cut interpretation of these results is made difficult by the fact that the solution of dopa becomes oxidized spontaneously in the presence of air, so that any tissue immersed in such solutions may become somewhat darker by absorption. It is seen, however, that cataractous lenses of any type become brown while the solution is still relatively clear, and much sooner than clear lenses. Brown cataracts become darker than other lenses and show the presence of black granules in section which are not seen in clear lenses. This seems to offer evidence that a substance is present in such lenses which reacts with dopa to form a brown color and that this substance is present in greatest amount in cataracta brunescens.

Possibly dopa-oxydase is present in the lens, as it is in other ectodermal structures such as the skin, hair, and nails. In order to explain how such a ferment accounts for the color of cataracta brunescens and nuclear sclerosis, some such theory as the following might be proposed. Substances chemically akin to dopa which oxidize to form melanin when in contact with a special ferment are present in the normal lens but are combined in the lens protein in such a way that the oxydase which is also present cannot react with them. The oxydase being freely soluble continues to be formed, probably by living cells near the capsule, but is lost through the capsule by dialysis without leaving any color since no free tyrosine is present to react with it. In cortical cataract free tyrosine is formed as the lens proteins break down. This process occurs chiefly outside the nucleus, however, where free tyrosine may also escape through the lens capsule as fast as it is formed. A very much slower process occurs in the nuclei of sclerotic lenses. Here the processes of absorption and loss of fluid are exceedingly slow as shown in a previous paper[7]. Free tyrosine remains here long enough to react with the minute amounts of oxydase which are also present, resulting in a brown substance. When once formed, this is insoluble and its color is irreversible. It continues to accumulate throughout life in amounts which are minute but which account for the gradual darkening of the senile lens.

Fig. 3 (Gifford and Puntenny). Section of brown cataract left in dopa 1½ hours.

The exact chemical nature of the unpigmented substances that are oxidized to form melanin remains in doubt. Jess[37] reported that melanin formed 3.1 percent of alpha crystallin, 0.36 percent of beta crystallin and 1.6 percent of albumoid in the normal lens. He gives no details of his method but since the lenses examined were not colored, it may be assumed that he refers to the unoxidized substance which yields melanin on oxidation. Krause[39] points out that tyrosine, cystine and leucine all form melanin in the presence of ultraviolet light and that these substances absorb most of the ultraviolet which the lens is known to absorb. It seems not unlikely that ultraviolet light may hasten the color formation in cataracta brunescens. From this statement of Krause it is apparent that the term melanin is used to cover a group of dark-colored substances whose exact chemical composition may vary considerably. Bodansky[40] concludes that the chemical constitution of melanin has not been determined, but that it is derived from tyrosine through several intermediate products, of which dopa is one.

Summary

1. Cataracta nigra or cataracta brunescens includes extreme examples of a lens change identical with that in nuclear sclerosis.

2. This is distinguished by a relative increase in the organic solids of the lens with relation to water.

3. In this it differs definitely from cortical cataract, in which a loss of solids occurs.

4. It may hence be considered the result of normal processes allowed to go on without the intervention of pathologic changes involving death of the lens fibers.

5. The theories that the color of brown cataract is due to blood pigment or absorption of melanin from the uveal pigment are without foundation.

6. The theory that the color is due to purely physical processes of light absorption is untenable, since colored solutions may be obtained from brown cataract.

7. No evidence was found that free tyrosine or tyrosinase are present in the normal or cataractous lens.

8. Reactions with dopa indicated that a ferment capable of oxidizing dopa to melanin is present in the cataractous lens, and that greater amounts are present in brown cataract and nuclear sclerosis.

9. A theory is proposed which may explain the color of cataracta brunescens as due to the reaction of such a ferment on substances developed from the lens protein.

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Discussion: Dr. C. A. Clapp: I would like to ask Dr. Gifford if the brown condition is the cause of myopia or if this occurs in all myopic cataracts.

Dr. Gifford: I think both are true, Dr. Clapp. I think the lens becomes sclerotic and the myopia increases. This type of cataract is undoubtedly more common in myopic eyes than in others. I mean it is more common in people who originally had high myopia than in normal eyes. I think that is well recognized. Besides that, when the lenses become sclerotic, the eyes become even more myopic. Of course, it is well known that certain normal people develop myopia due to pure nuclear sclerosis.

Dr. Frederick H. Verhoeff: You cut a section of a sclerosed lens and you often find it full of minute vacuoles. Microscopically they stain blue with hematoxylin. Have you any idea what this blue substance is?

Dr. Gifford: I suppose it is calcium. It is found near the capsule in the liquefied cortex.

Dr. Verhoeff: It isn't liquefied at all. It is in sclerosed lenses. It occurs all through the whole lens.

Dr. Gifford: I suppose it is calcium. I suppose there have been a certain number of other cortical changes in the lens, and it is probably calcium, because of course other cortical changes do occur in these lenses, too. What little cor-

tex is left around the outside can often have cortical opacities.

Dr. Otis R. Wolfe: I would like to ask whether you found that more in one sex than the other.

Dr. Gifford: I don't think so, Dr. Wolfe.

Dr. Wolfe: I have found it more in elderly females.

Dr. Gifford: Gordon Walls brought up the question whether brown cataract ever occurs in the albino. I have never seen a case nor heard of one. Theoretically it should not occur in albinos, who have no dopa-oxydase in the skin, and should have none in other ectodermal structures.

Dr. Earl L. Burky: Some of our lens solutions that contained alpha and beta developed color very much like yours. Those are from animal lenses and probably some chemical manipulation caused it.

Dr. Gifford: I assume, of course, that both of these things are present; both the ferment and dopa are present at certain stages in the lens. In order to get the brown color, you have to have them both present at the same time. I assume the ferment is being formed and lost from the lens all the time and so is the free dopa, but in most cases they are lost so fast that they don't form any color. It is only in the sclerotic lenses that they stay together long enough for the change in color to occur. When it does occur, it stays. In your solutions you might have artificially produced those conditions by hydrolysis of the lens.

Dr. Burky: It occurred in solutions that stood a long time.

Dr. Gifford: I think I noticed that in the solutions we used to make.

Dr. Arthur M. Yudkin: I would like to ask Dr. Gifford whether he found any brown cataract formation accompanying Krukenberg's spindles, in view of the fact that you say that some of these brown cataracts are accompanied by myopia and according to the literature Krukenberg's spindles are most usually accompanied by it.

Dr. Gifford: I think that would be a coincidence. I have seen three good cases of Krukenberg's spindles. One of the cases had a cataract, in a rather young woman; it was not of the brown type. In the other cases I haven't noticed that. The spindle in Krukenberg's spindle has a different basis from this. It is uveal pigment that sticks to the cornea. It has nothing to do with this.

THE BIOCHEMISTRY OF THE LENS

III. Water equilibrium in the normal and cataractous lens

JAMES E. LEBENSOHN, M.D.
CHICAGO

The lens has less water than any other tissue, but its curve of water content from the embryonic to the adult stage parallels, in general, that of the body. The soluble and insoluble proteins continuously increase in absolute amounts, but the metabolically active crystallins increase in direct proportion to the increase in lens surface, while the metabolically inactive albumoid accumulates in proportion to the square of the lens weight.

The water content of the lens is determined by the balance of osmotic, imbibitional, and tension forces. In cataracts and in autolyzed lenses the normal balance between osmosis and imbibition is upset, in that an increased osmosis accompanies a lessened imbibitional power.

The cataractous change is intimately dependent upon autolysis; the numerous biochemical deviations discovered are explained as the result of processes conditioning, involving, or ensuing from autolysis, whose primary prerequisite is local acidosis.

From the Department of Ophthalmology, Northwestern University Medical School.
Read before the Association for Research in Ophthalmology, in Milwaukee, June 13, 1933.

Water is so intimately related to the chemical structure and function of living tissues that among mammalia individuals whose bodies have the same relative water content can be considered of similar physiologic age. The various mammals are not born with the same degree of maturity. The human at birth has a water content of 82 percent, while that of the newborn calf is 76 percent, a percentage not reached by man till the age of six months. After birth, the water in the tissues decreases very rapidly for a certain period, and then the change suddenly becomes slow. Moulton[1] considers this critical point the age of chemical maturity, and he finds that if the age of the animal then reached is calculated from the date of conception, this figure when multiplied by 4.6 will give its life span. In general, then, the phases of chemical alteration follow the water content of the body.

The probable length of life of any mammal, apart from accident or disease, can also be calculated from the rule that the life span in years is half the number of days required to double the birth weight. The newborn child doubles its initial weight in 180 days; the calf in 48 days. Their possible longevity accordingly would be 90 and 24 years, respectively. Based on the equivalence of ages, then, the lens from a 16-year-old cow would correspond to that from a 60-year-old man. In comparing man with the albino rat, Donaldson[2] found a similar percentage of water in the brain at equivalent ages.

The lens at all times has somewhat less water than any other tissue, but its curve of water content from the embryonic to the adult stage parallels, in general, that of the body. From birth to four years, the water content of the

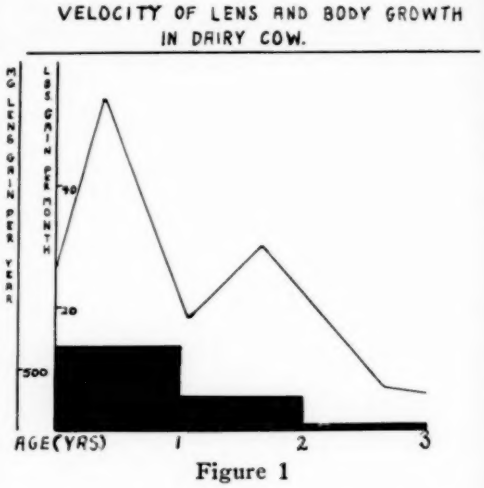

Figure 1

cow's body decreases from 76 to 69 percent, while that of its lens changes from 68 to 64 percent, in this period. From conception to adolescence, all mammalia show three periods of marked growth velocity, termed, by Brody and Ragsdale[3], the infantile, juvenile, and adolescent cycles, the influence of which is likewise reflected in the growth of the crystalline lens (fig. 1).

The calf lens which at birth weighs 0.928 gm., gains 0.680 gm. the first year, 0.329 gm. the second, and only 0.047 gm. the third. The annual increase thereafter for the fourth and fifth years is 0.135 gm., from the sixth to ninth years 0.059 gm., and from the tenth year on, but 0.025 gm.

As long as the lens continues in physiologic health both its soluble and insoluble proteins increase in absolute amounts (fig. 2). However these two divisions of lens protein follow definitely different laws of growth (table 1). The absolute amount of soluble crystallins increases in direct proportion to the increase in lens surface. Since this is the metabolically active constituent of the lens, it is significant in this connection that the total available water of the various mammals is similarly directly proportional to their body surfaces.

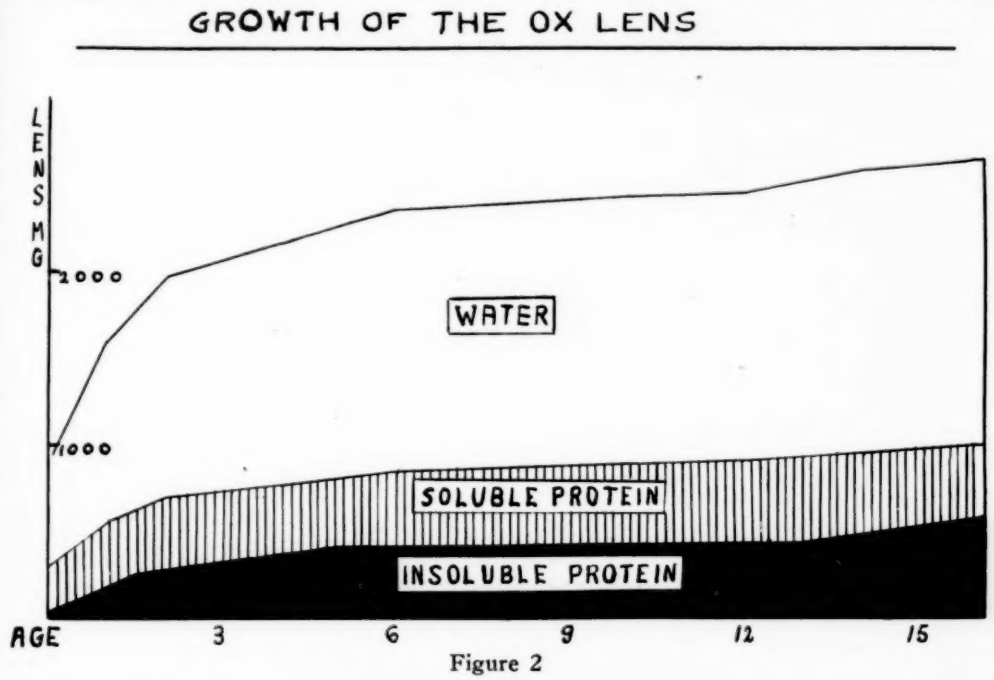

Figure 2

In table 1, the data of lens weight of cattle at various ages, and the respective amounts of soluble and insoluble protein are the figures of Jess[4]. The lens areas have been derived from

Table 1

LENS PROTEINS IN RELATION TO LENS WEIGHT AND SURFACE

Age	Weight of Bovine Lens (a)	Percent Albumoid (b)	$\frac{R}{a/b}$	Lens Area (calculated) Sq. Cm. (c)	Soluble Proteins Gm. (d)	$\frac{R}{c/d}$
Weeks						
5	0.9309	7.37	1.26	4.468	.2322	19.2
Years						
1.5	1.8522	14.57	1.27	7.068	.3691	19.2
3.5	2.0525	16.41	1.28	7.569	.3815	19.8
5.0	2.1570	18.00	1.20	7.824	.3774	20.7
13.0	2.5000	18.75	1.36	8.633	.4313	20.0
16.0	2.6584	19.65	1.35	8.944	.4479	20.1
16.0	2.6788	20.40	1.31	9.040	.4313	21.0
16.0	2.7598	21.47	1.29	9.221	.4106	22.5
16.0	2.7944	21.36	1.31	9.515	.4230	22.6

their weights, using 1.073 (Priestley Smith's figure for the specific gravity of the human lens) as the specific gravity throughout. The ratio of the designated lens surfaces to the soluble proteins deviates little from a constant, 20.0, with a variation of but 2.6 percent. If the higher specific gravity of the older lenses had figured in the calculations, the variations would be even less.

The ratio of the weight of the lens to the percent albumoid in the whole lens likewise approaches a constant, 1.297, with a variation of 2.8 percent. Thus, whereas the albumoid content of a five-week calf lens weighing 0.9 gm. is 7 percent, that of a 16-year-old cow lens of 2.7 gm. is 21 percent. Expressing this idea mathematically, albumoid/lens weight: lens weight = K; or, simplifying the equation, albumoid/(lens weight)^2 = K; that is, the absolute amount of albumoid is in direct proportion to the square of the lenticular weight. These principles, that the crystallins increase only with the lens surface, while the albumoid increases with the square of the lens weight, account satisfactorily for the fact that the relative proportion of albumoid steadily mounts with the progressive growth of the lens.

The water content of the lens is determined by the balance of osmotic, imbibitional, and tension forces. The osmotic pressure of the lens has been stated to be equal to 1.25 percent saline, because in this solution no change in volume occurs[5], nor does the lens in a solution of this strength induce any change of electrical resistance[6]. But in cryoscopic determinations of ground lens pulp, the osmotic pressure is only equivalent to 0.9 percent saline[7]. The difference between the two findings is to be attributed to imbibitional forces.

The imbibitional property of protein is principally modified by pH, electrolytes, aging, lipoid content, and proteolysis. The pH of the lens is 7.5; its isoelectric point, where imbibition is at its minimum is pH 5.16[8]. Consequently acidification to this point tends to cause dehydration.

Aging of proteins, otherwise known as syneresis, is accompanied by an increase in the aggregation of their particles; and a decrease in imbibitional capacity and chemical activity. In the lenses from old cows I found that the water content of the cortex was 69.87 percent while that of the nucleus, which has been constituted by this process, was but 50.67 percent. Buglia[9], who investigated this point, obtained very similar data, his figures being 70.24 percent and 51.32 percent, respectively.

For a more precise analysis of how the aging process affects the distribution of water in the lens, I determined the amount of water retained through the range of relative vapor pressures by lenses of various ages. The labile water of tissue has been called "free," while that portion which is so closely attached to the tissue colloid as not to be capable of acting as water of solution, or of freezing at low temperature has been labeled "bound"[10]. According to Briggs[11], all the water in the tissue is really bound, and changing conditions only affect the strength of this binding power. As a working conception, however, that part of the water content which can be withdrawn under a standard desiccating force can be considered "free," and that which is retained as "bound."

In the experimental study, lenses were placed in desiccators kept in a constant-temperature room which contained sulphuric acid-water mixtures spaced at 5 percent intervals from 25 to 70 percent. This gave a relative-vapor-pressure (R.V.P.) range from 81 to 4[12]. The weighed lenses were kept over these mixtures for a period of six weeks until constant weight was attained. Then the lenses were removed, weighed, and completely desiccated in 100-percent sulphuric acid under vacuum. From the difference in weight, the amount of water retained per gram at the various vapor pressures could be calculated, and the vapor-pressure isotherm plotted. This method, which was used by Katz[13] in an intensive study of imbibition, can be used only with sulphuric-acid mixtures above 25 percent, as the lens is attacked by

Table 2

DESICCATION OF LENSES

The water content per gram at various relative vapor pressures. Determined in desiccators with varying content of sulphuric acid.

H_2SO_4 Content Percent	R.V.P.	Unborn Calves	2-yr. Steers	10 to 16-yr. Cows	10 to 16-yr. Cows	
					Cortex	Nucleus
0	100	3.0037	1.7144	1.5142	2.3194	1.0207
25	81	.2083	.2097	.2060	.2120	.2032
30	75	.1565	.1704	.1683	.1974	.1888
35	67	.1505	.1469	.1410	.1407	.1317
40	56	.1125	.1176	.1038	.1116	.1041
45	46	.0983	.0960	.0933	.0806	.0849
50	35	.0895	.0797	.0805	.0718	.0843
55	25	.0654	.0663	.0612	.0604	.0599
60	16	.0432	.0456	.0377	.0323	.0518
65	9	.0321	.0327	.0219	.0241	.0239
70	4	.0134	.0166	.0194	.0028	.0076

microörganisms in higher relative humidities.

The decapsulated lenses of unborn calves, steers, and old cows, and the cortical and nuclear portions separately of old cow lenses were thus studied. The data presented in table 2 and figure 3 show a practically identical vapor-pressure isotherm below 81. The differences in water content are entirely in the free-water domain.

In a second experiment, a reverse procedure was adopted, and in the series of desiccators were placed powdered desiccated lenses from unborn calves, steers, and human cataracts. To

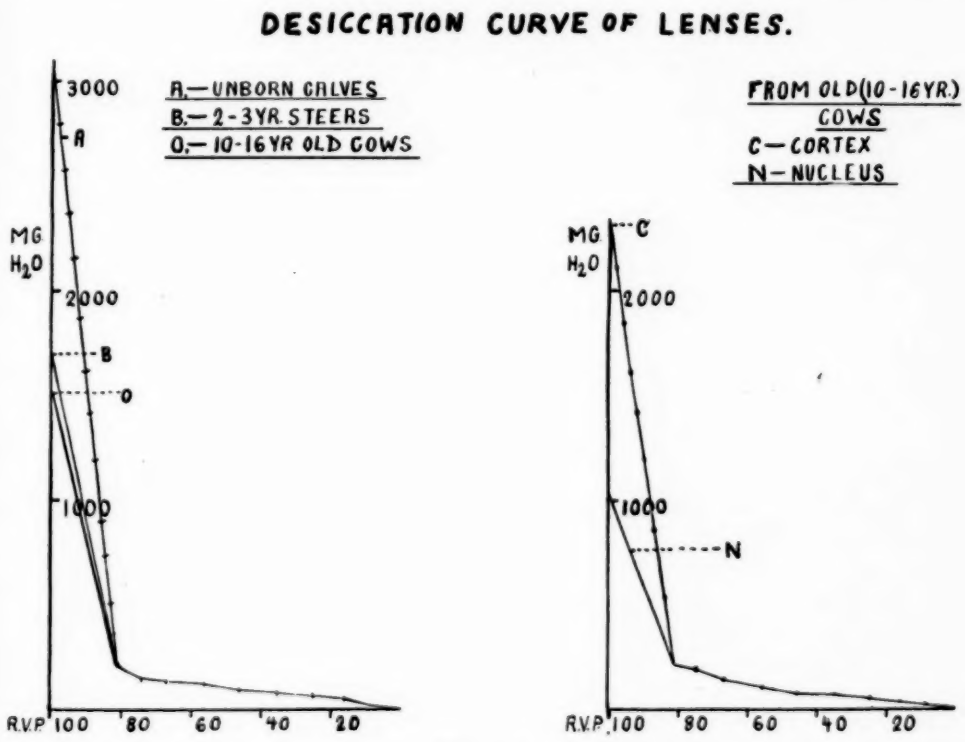

Figure 3

Table 3

IMBIBITION OF DRIED AND POWDERED LENS SUBSTANCE

The water content per gram at various relative vapor pressures. Determined in desiccators with varying content of sulphuric acid.

H_2SO_4 Content Percent	R.V.P.	Human Intracap. Cataracts	Unborn Calves	2-yr. Steers
25	81	.1904	.2067	.2081
30	75	.1619	.1867	.1890
35	67	.1440	.1590	.1594
40	56	.1187	.1323	.1330
45	46	.0980	.1120	.1129
50	35	.0826	.0930	.0938
55	25	.0699	.0704	.0728
60	16	.0535	.0566	.0598
65	9	.0404	.0365	.0364
70	4	.0270	.0265	.0264

Dr. O. B. Nugent I am indebted for a box of 190 cataracts, intracapsularly removed by him in India, the average desiccated weight of which was 0.054 gm. When imbibition was at equilibrium, the vapor-pressure isotherm of the bovine lens material, as is characteristic of elastic gels, repeated the curve obtained in the process of desiccation. The cataract material, however, exhibited a definite deficiency in imbibition above R.V.P. 56, indicative of the profound change in the lens colloid effected by the cataractous change (table 3, fig. 4).

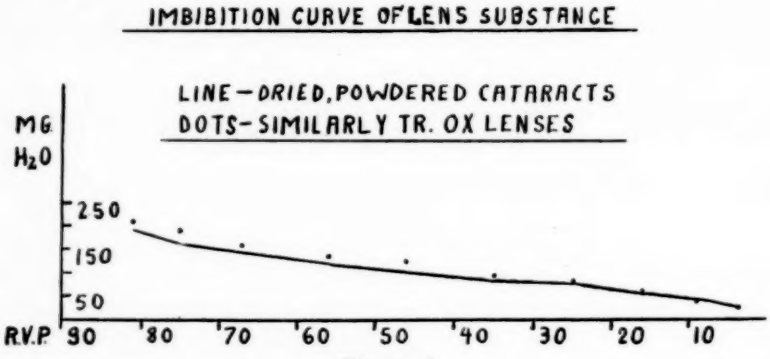

Figure 4

It is significant that in gelatine, Sheppard and Houck[14] found that the water-binding capacity was reduced as hydrolysis progressively shortened the chain.

Some cholesterin and fat are intimately adsorbed in living proteins and influence considerably their imbibition. Whereas fat is hydrophobic, cholesterin-esters (as in lanolin) are markedly hydrophilic. The higher the ratio is of cholesterin to fatty acids—what Mayer and Schaeffer[15] call the lipocytic coefficient—the more water the tissue should contain. This is true of young as compared with old lenses, as is illustrated in table 4 in which the figures of Lavagna[16] for horse lenses are utilized. The very low lipocytic coefficient of his cataractous lenses agrees with the evidence presented and to follow, that an impaired imbibitional power of lens protein accompanies the cataractous process. In spite of this, however, an increased water content occurs because of osmotic changes incident to tissue breakdown.

The increased imbibition manifested by tissues when placed in distilled water is likewise proportional to their

Table 4

THE LIPOCYTIC COEFFICIENT OF LENSES
From data of Lavagna on horse lenses

Equine Lens	Water Content Percent	Cholesterin Percent Dried Wt.	Fatty Acids Percent Dried Wt.	Lipocytic Coefficient
Young	66.3	.471	.026	18.12
Old	64.2	.821	.053	15.49
Cataracts	71.5	7.190	3.360	2.14

Table 5

IMBIBITIONAL CAPACITY OF VARIOUS TISSUES

Tissue of Dog	Water per gm. Dried Wt. in Vivo	Maximum Imbibition in Distilled Water	Increase Over Normal Imbibition
Lung	3.52	12.22	8.70
Kidney	3.15	6.78	3.63
Liver	2.36	4.18	1.82
Lens	1.56	2.56	1.00

lipocytic coefficient. In table 5 and figure 5, the tissues of the dog are arranged in the order of their water content per gram dried weight. (The data, except for the lens, are those of Mayer and Schaeffer.) As is thus clearly shown, the more water a tissue originally contains, the more it can imbibe when placed in distilled water.

Just as the osmotic pressure of the

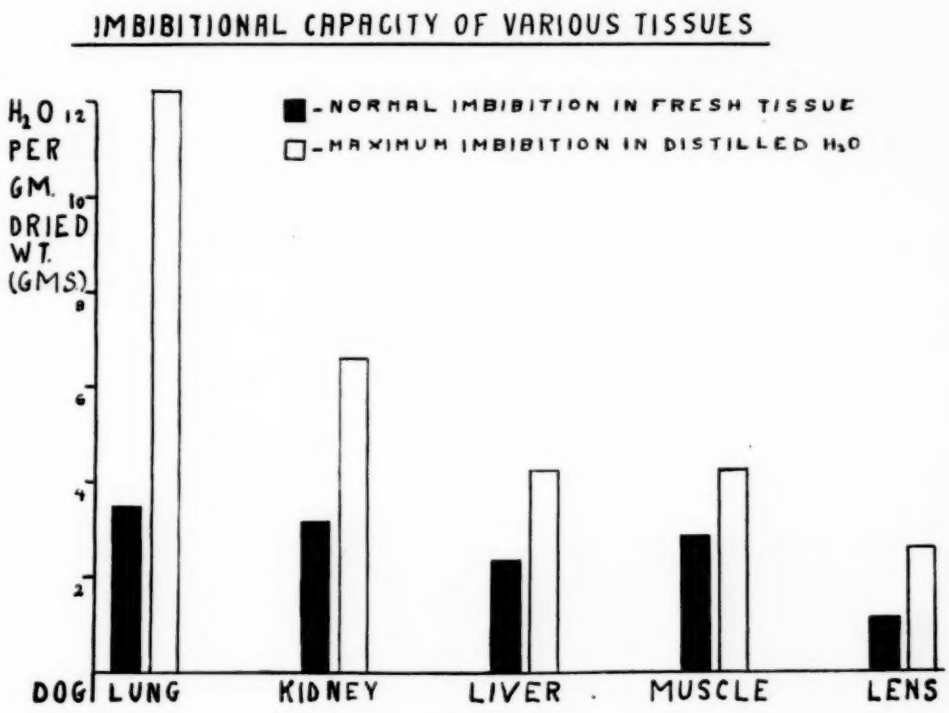

Figure 5

lens can be measured in a graded series of salt solutions, so the imbibitional or oncotic pressure can be determined by the reaction of the lens to increasingly concentrated protein solutions. The lens competes against the solution protein for water, and the equilibrium point, therefore, is a measure of its oncotic pressure[17]. In table 6, the reaction of bovine lenses to oncotic and osmotic pressures is compared. From dried serum, 1 percent to 15 percent solutions were made, and the change per gram of the immersed lenses after 48 hours in the refrigerator was noted. Though the younger lenses reacted more strongly to differences in the protein content of their media, all the bovine lenses appeared at equilibrium in the 12-percent protein solution. However, when allowance is made for the swelling due to unavoidable autolysis during the period of the experiment, the oncotic pressures for the lenses of old cows, steers, and unborn calves would correspond to about 7, 8, and 9 percent serum protein, respectively.

Table 6

LENS REACTION TO OSMOTIC AND ONCOTIC PRESSURES

Percent NaCl	Water Change per gm. Lens (steer lens)	Percent Serum Protein	Water Change per gm. Lens. (Refrigerator 48 hrs.)		
			Old Cows	2-yr. Steers	Unborn Calves
0.0	+.3528	0	+.3230	+.3528	+.5500
0.2	+.1873	1	+.1870	+.2131	+.3584
0.4	+.1538	2	+.1700	+.1506	+.2603
0.6	+.1426	4	+.1129	+.0797	+.2138
0.8	+.1000	9	+.0478	+.0135	+.1021
1.0	+.0767	11	+.0437	+.0103	+.0677
1.2	+.0305	12	+.0182	+.0053	−.0555
1.4	−.0200	15	−.0146	−.0257	−.0585

The effect of hydrostatic pressure on the lens was determined in the following manner: Two perforated glass discs just large enough to enter the test tube were joined together by a short glass rod. Between two such spools, the lenses were placed individually; the test tube then filled with 10 c.c. Ringer's solution; and a closely fitting corked test tube containing a varying amount of mercury was gently placed over the upper spool. From the total weight over the lens, the pressure in mm. mercury was calculated. The apparatus was placed for 48 hours in the refrigerator, and the resulting change in lens weight was then noted. The results (table 7) indicate that it requires 165 mm. mercury to keep the lens from swelling in Ringer's solution, which accordingly is a measure of the imbibitional force under these conditions. It was impossible to express water from the lens by further pressure up to 288 mm. mercury, the upper limit of resistance of the lens capsule.

In autolysis more particles are produced, which results in increased hydration because of increased osmotic pressure, though the oncotic pressure—as shall be shown—is at the same time reduced. Autolysis in the refrigerator, as measured by increased hydration, proceeds at a fairly even rate (table 8). This has likewise been found true

Table 7

EFFECT OF HYDROSTATIC PRESSURE ON THE ADULT BOVINE LENS IN RINGER'S SOLUTION

Pressure Mm. Hg	0	83	100	165
Change per gm. lens	+.0890	+.0238	+.0084	+.0014

Table 8

RATE OF IMBIBITIONAL CHANGE WITH AUTOLYSIS

Days	1	2	4	6	8
Gain in water per gm. lens	.0479	.0622	.1412	.1771	.2373

of the nitrogen that dialyzes through the lens capsule when determined for successive two-hour periods[18].

Inasmuch as a considerable array of evidence suggests that autolysis plays an important rôle in the cataractous changes, the behavior of autolyzed lenses in respect to their oncotic pressure was next investigated. Lenses were weighed, placed in Ringer's solution, and allowed to autolyze six days in the refrigerator. They were then transferred to solutions of serum protein of various percentages, and the change in weight after 48 hours was noted. In a control group of lenses, autolysis was allowed to continue for the entire eight-day period. The results, summarized in table 9, show that, if the further autolysis undergone while in the protein solutions be discounted, the oncotic pressures would be 5 percent and 9 percent for old and young lenses, respectively; while if allowance be made for the continued autolysis, the oncotic pressure of old lenses is less than 1 percent, and of young lenses about 2 percent. The graphs in figure 6 depict the reaction of the lens to osmotic, hydrostatic, and oncotic forces, and contrast the difference between fresh and autolyzed lenses in relation to their oncotic pressure. In naphthalene cataract, the lens in the incipient stage of the cataractous process takes up in Ringer's solution more water than does the normal lens or the lens with mature cataract, presumably because its protein is in the process of breakdown, while in the other cases, breakdown had not yet occurred *in vivo*, or was almost completed[18]. Characteristic of naphthalene cataract is the formation of vacuoles between the cells, the accumulation of water beneath the capsule, and water-splitting of the sutures[19]. The fact that in autolysis there is no longer the normal balance between osmosis and imbibition—in that an increased osmosis accompanies a lessening of imbibitional power—gives the probable explanation of these findings. Young bovine lenses with their greater imbibitional capacity do not develop water fissures as readily as old lenses; and, if a high osmotic or oncotic pressure in the solution limit the water intake of the lens, water deposits will likewise fail to develop[18].

From a study of the best available

Table 9

ONCOTIC PRESSURE OF AUTOLYZED LENSES

After 6 days' autolysis in refrigerator, lenses were placed for 48 hours in various strengths of serum protein solution

Old Bovine Lenses (Av. Wt. 2.360 gm.)				Young Bovine Lenses (Av. Wt. 1.855 gm.)		
Anticipated increase from autolysis 6–8th day		+.1421		+.1117		
Percent Serum Protein	Wt. change	Deviation from +.1421	Deviation per gm. Lens	Wt. Change	Deviation from +.1117	Deviation per gm. Lens
1	+.1076	−.0345	−.0146	+.1224	+.0107	+.0058
3	+.1048	−.0371	−.0157	+.0945	−.0172	−.0093
5	+.0020	−.1401	−.0594	+.0420	−.0697	−.0376
9	−.0391	−.1812	−.0768	+.0070	−.1047	−.0564
12	−.0675	−.2096	−.0888	−.0255	−.1372	−.0740
14	−.1075	−.2496	−.1058	−.0786	−.1903	−.1026

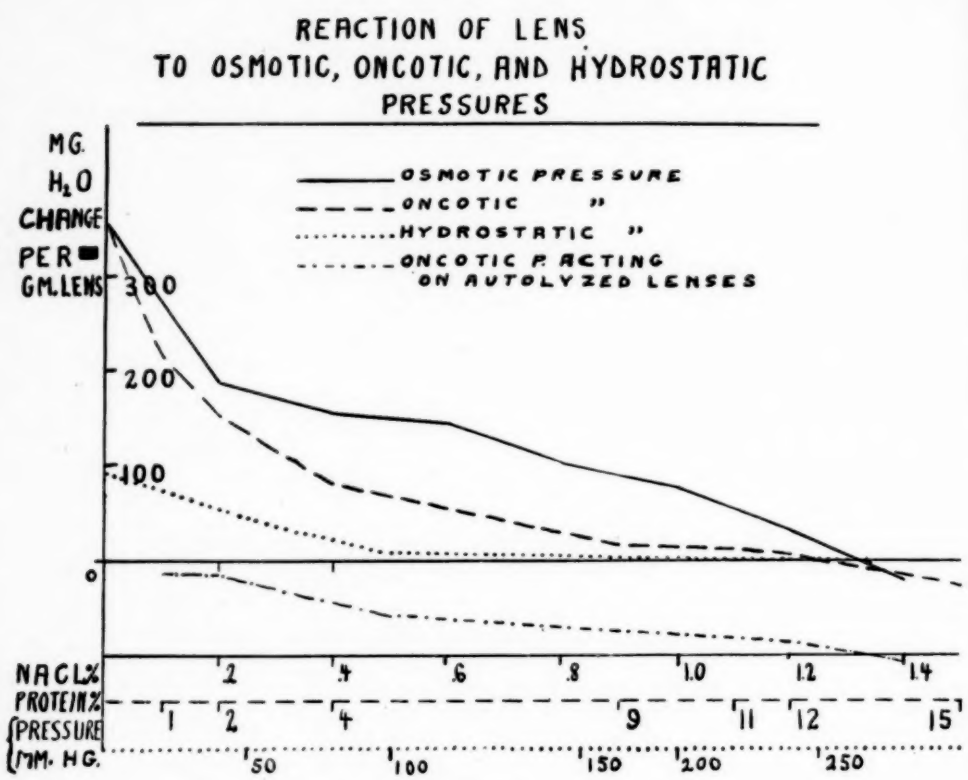

Figure 6

data in human senile cataract, the following changes in water content appear to occur: first, a dehydration; followed by a marked hydration; with a tendency finally towards progressive dehydration. Obviously the only data of value are those in which intact lenses, intracapsularly removed, have been investigated. In a number of mature cataracts, I found the average water content to be 76 percent, when intracapsularly removed; but when expressed after capsulotomy, 64.9 percent. Among Priestley Smith's[20] protocols are cases in which both lenses from the same individual were examined. In two individuals, with one normal lens, and incipient cataract in the other, the normal lens showed the lesser density; but in two other cases, with incipient cataract in one eye, and mature cataract in the other, the specific gravity of the incipient cataract was regularly greater (table 10). Kubik[21] gives 67.4 percent as the average water content of the normal senile lens; of the lens with incipient cataract, 66.22 percent; and that with mature cataract, 74.5 percent. The hydration of hypermature cataracts was high (77.8 percent), but less than in diabetic cataracts (80.5 percent). Salffner's[19] work on naphthalene cataract suggests that dehydration eventually ensues. He removed one eye from a series of rabbits, and produced naphthalene cataract in the other. In the stage of fresh opacity, he found the specific gravity decreased .0065 to .0129 while in the final stage of cataract, the specific gravity increased .0120. In this resorption stage, the loss of water evidently proceeded faster than the loss of substance.

The water changes, and all other deviations noted in the biochemistry of senile cataract are explainable simply as a result of processes conditioning, involving, or ensuing from autolysis. The researches of Bradley[22] and his associates have established that the

Table 10

CHANGES IN WATER CONTENT IN HUMAN CATARACT

Data of Priestley Smith		Data of Kubik	
Lens Type	Specific Gravity	Lens Type	Percent Water
A. 1. Normal	1.087	Clear	
Incip. cortical opacity	1.096	Normal	67.4
2. Normal	1.041	Luxated	67.3
Slight cortical opacity	1.075	Cataracts	
		Incipient	66.2
		Nuclear	67.9
B. 1. Slight cortical opacity	1.085	Immature	71.3
Complete cataract	1.082	Mature	74.5
2. Slight cortical opacity	1.105	Traumatic	76.8
Complete cataract	1.054	Diabetic	80.5
		Hypermature	77.8

primary autolytic protease only acts on acid protein, and that consequently a local acidosis is prerequisite in order that the normal base protein of the tissues be converted into available substratum. Lavagna[16], in examining the normal and cataractous lenses of horses, found that, whereas the pH of the normal lens averaged 7.6, that of lenses in the stage of early cataract varied from 7.35 to 6.62. This local acidosis accounts for the primary water loss in incipient cataract.

Clapp[23] was among the earliest investigators to study autolysis in the lens. He found lenticular autolysis a relatively slow process, requiring six months to reach its maximum. He also demonstrated a proteolytic ferment in the aqueous. Lens suspensions with unboiled aqueous showed much greater proteolysis than similar suspensions with boiled aqueous, or saline solution. Goldschmidt[24] from his experiments concluded that three factors must be considered in the proteolysis of the lens: (1) aqueous ferments, (2) autolytic ferments in the lens, and (3) blood elements, which first appear in 24 hours after trauma to the lens, without, however, any inflammatory symptoms of the bulb accompanying. Rodigina[25] found that the protease content of the aqueous in the resorption process of cataract increased two to four times.

In senile cataract the following findings, besides those already noted, have been demonstrated: A diminution of respiratory activity[26], and of glutathione[27]; and a decrease in the soluble crystallins[28], nitrogen[29], and potassium[30]. Lecithin, calculated in percent dried weight, becomes somewhat less with age; in incipient cataract it is relatively increased, and markedly diminished in mature cataract[16]. On the other hand, there is in cataract an increase of cholesterin[31], calcium[32], and sodium[33]; and also an increase of amino-acids, peptones, and fatty acids[16]. Leucine crystals were found in the lens by Baas[34], sulfhydril compounds in the aqueous by Schmerl and Thiel[35], and tyrosine in the lens and aqueous by Burdon-Cooper[36]. An increased concentration of the aqueous in cataract has been demonstrated by Peters[37] by conductivity measurements, and Giannantoni[38] has found in the aqueous a progressively increased refractive index in incipient cortical, mature nuclear, and mature cortical cataracts.

Do not all these changes result directly or indirectly from autolysis? Consider the loss of potassium, an element as intimately associated with the tissues as sodium is with the body fluids. In a study of metabolism in starvation, Gamble, Ross, and Tisdall[39] deduced from the close parallelism be-

Table 11

BASE BALANCE IN NORMAL AND CATARACTOUS LENSES

A. From data of Mackay, Stewart, and Robinson (Human lenses)

Figures, As Originally, in Percent Dried Wt.				Calc. in Milliequivalents per Liter Water of Lens			
	Normal	Immature	Mature		Normal	Immature	Mature
Na	.385	.603	.622	Na	108.7	186.0	223.4
K	.635	.309	.092	K	132.8	56.1	19.4
H_2O	154.	141.	121.	Total	241.5	242.1	242.8

B. From data of Evans and Kern (Dog lenses)

Original Figures for Bases in Percent Ash			Calc. in Milliequivalents per Liter Water of Lens		
	Normal Dog	Parathyroid Cataract		Normal Dog	Parathyriod Cataract
Ash (mg.)	4.4	2.8			
Na	9.4	17.4	Na	62.9	76.2
K	31.3	21.6	K	123.6	55.7
Mg	.8	2.0	Mg	10.2	16.6
Ca	1.5	28.7	Ca (½)	5.8	72.2
Water %	61.0	64.0	Total	201.5	220.7

tween the excretion of potassium and nitrogen, that the former is derived from cellular destruction. Hence when nitrogen is lost, potassium disappears concurrently. Cholesterol is not destroyed by autolysis[40], and consequently accumulates wherever tissue disintegration occurs. The calcium gain follows inversely the nitrogen loss, so that either determination gauges the extent of the cataractous process[32]. The calcium accumulates probably as a consequence of the progressively diminishing lenticular respiration, or possibly because of interaction with liberated amino-acids, fatty acids, or phosphate ions.

The lens must necessarily be at all times in osmotic equilibrium with its media. Since the aqueous in cataract tends to be more concentrated, the lens in the cataractous state has presumably a somewhat higher osmotic pressure than when normal. The ash and water content in cataract are less in absolute figures, but are increased in relation to the diminished weight of the cataractous lens, the ash content forming 1.44 percent of the wet weight in senile cataract, in contrast to 1.04 percent in the normal lens[33]. The interior of the lens must also be in osmotic equilibrium with its periphery. In the autolyzed cortex are proteoses, peptones, and amino-acids, which at the pH of the lens act as anions and require cations to bind them. Consequently added base must enter the lens, especially so since nitrogen in leaving depletes the potassium supply. The increase in sodium and calcium, with the accompanying decrease of potassium were first discovered by Burge[30], and confirmed since by Evans and Kern[41], and by Mackay, Stewart, and Robinson[33]. In table 11 and figure 7, the data of these investigators have been recalculated in terms of millimol equivalents per liter water of the lens. Since the cataracts examined by Mackay, Stewart, and Robinson were removed by expression, the material consisted principally of the nuclear and perinuclear substance. The recalculated data show that in this portion of the lens, the gain in sodium merely compensates osmotically for the potassium deficiency.

Evans and Kern compared intracapsularly removed lenses of normal dogs with those that developed cataract after parathyroidectomy. Considering that these cataracts were less than a year old they were probably in the immature stage. The sodium in these parathy-

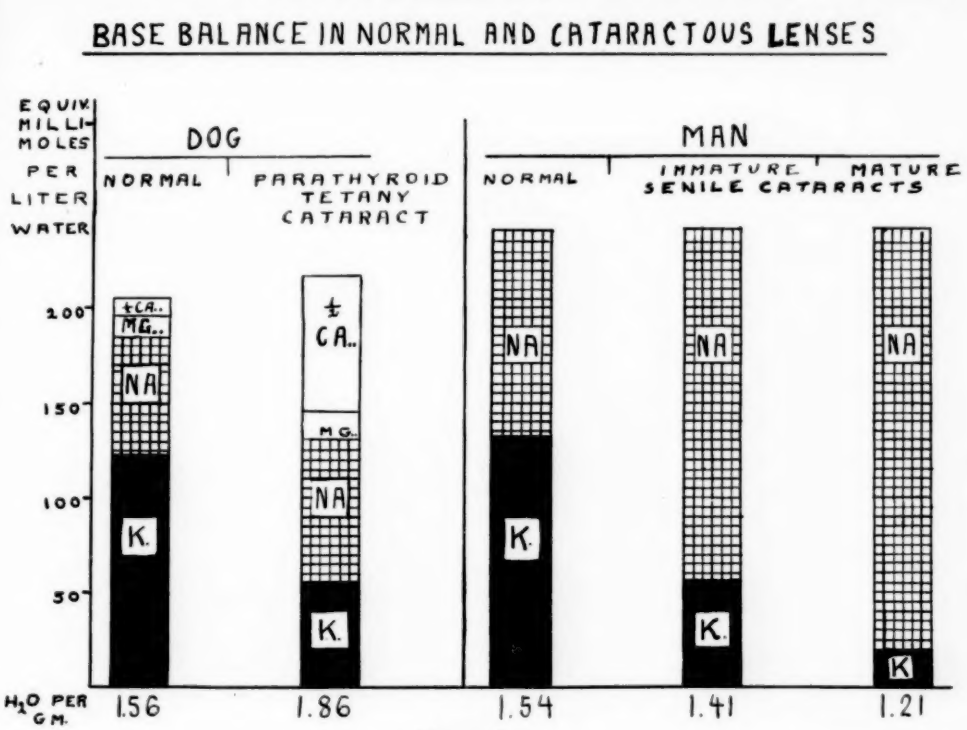

Figure 7

roidectomy cases does not completely compensate for the potassium loss. But if the magnesium, and half the calcium —the proportion that is diffusible in the blood plasm—are considered in the calculations, a total is reached that gives the osmotic pressure of the cataractous lens as just appreciably higher than normal.

The isoelectric point of alpha crystallin is pH 4.8; of beta crystallin, pH 6.0[42]. Accordingly it would require but a slight acid shift to convert beta crystallin into acid protein, and so render it susceptible to autolysis. Tsuji[43] has, in fact, demonstrated that in naphthalene cataract the disappearance of beta crystallin precedes that of alpha crystallin. Lecithin, with its isoelectric point at pH 4.7[44], is similarly slow to autolyze. Alpha crystallin, by buffering the local acidosis, tends to protect beta crystallin from autolytic attack. With increasing age, alpha crystallin decreases in the lens, and this fact plausibly accounts for the special susceptibility of aged individuals to the cataractous change.

In the examination of the cortex and nucleus of aged bovine lenses, I found that per gram dry weight the cortex contained 0.22 mg. lipoid phosphorous, and 3.81 mg. cholesterol; the nucleus, 0.13 mg. lipoid phosphorus, and 5.85 mg. cholesterol. The accumulation of cholesterol in the nucleus and the loss of lipoid phosphorous suggests that normally a certain degree of autolysis may accompany the aging of lens fibers. Goldmann, working with Siegrist[45], has shown that by varying the intensity of naphthalene poisoning, different types of cataract can be produced. The idea that cataract and aging represent different degrees of a similar process, if valid, would reconcile the assertions of Vogt, Elschnig, and Salus, that senile cataract is but the result of progressive involution, with the views of others, such as Hess, Römer, Goldschmidt, and Dor, who consider senile cataract a true disease.

310 South Michigan Avenue.

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HETEROCHROMIA AND CATARACT

Report of a case

AMBROSE EARL EDGERTON, M.D., M.Sc.
SAN FRANCISCO

The case described was associated with cataract, cyclitis, and depigmented iris. It is classed with the type secondary to inflammatory processes and cervical sympathetic disturbance.

Hutchinson, in 1869, was the first to describe a case of heterochromia. Twenty years later Gunn and Sym each reported several additional cases and since that time numerous investigators have studied and described this interesting condition with varied conclusions.

The course of the disease is a chronic one and extends over a period of many years. About three hundred cases are reported in the literature, the distribution of sex being about equal. It is usually unilateral. King, who brought the literature up to date in 1927, stated that, with two exceptions, the disease in all cases was confined to one eye. Patients are most often affected during the third and fourth decades of life, but one among the cases reported by Sym was only sixteen years of age. One may consider it a problem of heredity and in the uncomplicated cases it is usually ascribed to crossed inheritance.

The etiology of heterochromia is still in doubt and opinions differ as to whether the heterochromia is due to cyclitis or precedes any such changes. The condition may be pathologic or nonpathologic, partial or total, congenital or acquired. It may be classified as:

1. Congenital, partial or total.
2. Sympathetic, congenital or acquired.
3. Fuchs's type.
4. Depigmentation as a senile process.
5. Posttraumatic.

In congenital partial heterochromia, a brown sector may be present in a blue or a gray iris and King states that in these cases a pupillary membrane, high astigmatism, and medullated nerve fibers are often present. Congenital simple heterochromia, total or partial, is a developmental anomaly and is apparently not due to any pathological process. The dark iris may be only hyperpigmented. Melanotic areas may be seen on the sclera. This is an hereditary condition and as a rule the darker iris is thicker. Wolfrun claims that partial heterochromia must be regarded in the same light as complete variation in the color of the whole iris.

As a rule patients are not aware of any ocular changes until the complications of cataract and cyclitis cause some difficulty in vision. Gradle, who reviewed the literature, states that at times the pain of hypertension will cause patients to consult an oculist. This pain he believed to be due to contractures of the meshes of the pectinate ligament, decreased absorption of aqueous by the anterior surface of the iris, and to an increased output of aqueous by the ciliary body due to the inflammatory process. Four of his thirteen cases showed hypertension and two more reported by Lutz and three by Sym were complicated by glaucoma, but the majority of cases reported do not record any evidence of fundus changes.

Congenital heterochromia with paralysis of the sympathetic is rarer but one such case is reported by Koby. In heterochromia due to paralysis of the cervical sympathetic, the iris has a normal luster and a very delicate structure. Most writers have noticed miosis and a narrowing of the palpebral fissure, which they believe is due to a lesion of the sympathetic. Six cases reported by Lutz showed evidence of paresis of the cervical sympathetic on the side of the paler eye. Bistis in a series of experiments on rabbits, destroyed the superior sympathetic ganglion and found that in those which lived over six months a heterochromia developed. Similar results were produced by Angeluca and Calhoun. However, numerous investigators have performed operations on the cervical sympathetic

ganglion and did not observe any change in color of the iris, and many cases of heterochromia have been reported where there was no evidence of sympathetic paresis. Bistis concluded that heterochromia, unless preceded by ocular inflammation, was due to paralysis of the cervical sympathetic and that the deposits on the corneal epithelium were due to a vaso-motor disturbance, not to a cyclitis, and that cataract was the result of a disturbed intraocular balance secondary to vascular changes.

Scalini believed that heterochromia was due to sympathetic paresis causing a lack of nervous tone that brought about an increased permeability of the vessels, which accounted for the deposits and the disturbed metabolism resulting in cataract. Haessler suggests that sympathetic paresis can cause heterochromia only if it precedes the development of the anterior limiting membrane of the iris. In this connection it is interesting to note that Von Herrenschwand found eleven cases of enlarged thyroid in thirteen cases of sympathetic paresis heterochromia.

In the Fuchs type of heterochromia precipitates are present on the posterior corneal surface, and cataract and vitreous opacities are usually seen but there are no synechiae or marked exudative changes. The translucent deposits on the posterior corneal surface are composed of lymphocytes from the iris and ciliary body. Fuchs believed some change in uterine life to be responsible in this type which he describes, probably a maldevelopment of mesodermal pigment, which later in life leads to a low-grade inflammation. He thought that the lighter iris and cataract were the result of the cyclitis and that the normal pigmentation of the iris had been prevented by a disease of unknown etiology. In such an eye there is lowered resistance and cyclitis and cataract are prone to develop. Schlippe also concluded that the heterochromic eye was the result of a chronic cyclitis of unknown cause. Haessler stated that this unknown pathologic agent acts early in life and persists for years and produces no change in the eye, except heterochromia and its complications.

Streiff was of the opinion that there was a hypoplasia of the pigment-forming elements. He did not believe that the precipitates were due to inflammation but to nutritional derangements caused by vaso-motor disturbances of the ciliary body. Kraupa thought the inflammatory changes were due to developmental anomalies leading to metabolic changes and abnormal filtration. Heine, Galezowski, and Parsons were of the opinion that the depigmentation was the result of the uveitis.

Koby stated that an insidious uveitis is present, associated with white precipitates, depigmentation of the posterior layer, absence of synechiae and complicated later by cataract. Scattered precipitates are seen early with the slitlamp and dense opacities are seen in the vitreous. A bright polychromatic luster at the posterior pole of the lens is indicative of beginning cataract. The disintegration of the posterior pigment layer begins as a localized rarefaction of pigment which later forms actual holes. Meesmann found that these holes are often surrounded by a cloudlike corona. The pigment border is always involved and may disappear completely. Triangular lacunae, with their bases towards the pupil, are also formed. Pigment disintegration is always present in cases of complicated heterochromia but is not pathognomonic of this condition.

Gradle stated that in acute cases, with the slitlamp, the lymphocytes can be seen in the anterior chamber clumped against the posterior corneal surface. Their round form is due to surface tension. Later these precipitates shrink and become crenated and eventually are wholly absorbed by the aqueous. The anterior chamber is cloudy due to the presence of lymphocytes in the early stages of the disease and becomes clear during the quiescent stage. The lenticular opacities are first seen in the posterior subcapsular cortex and show as linear gray spicules. These gradually increase in size and form a disclike opacity between the nucleus and the posterior pole. Later peripheral spokelike changes occur followed by a diffuse opacity of the whole lens. The iris appears to be compressed and the normal fluffy appearance of its anterior layer is lost. The individual fibers do not

stand out distinctly. He describes short slender gray tags of tissue, extending from the pigmented pupillary border in the acute cases. These tags eventually disappear.

Székely studied thirty cases of this type all of which had post-corneal precipitation and cataracts. Sixty percent of his cases occurred between the ages of twenty and forty. He was inclined to think that tuberculosis was the etiological factor and cited six cases from Meller's clinic that were due to tuberculosis. King states that the precipitates in heterochromia are resistant to all influences but they diminished in his cases by the use of Tebeprotin and he believed that tuberculosis was an important etiological factor. The physical examination of the lungs in five of his cases revealed positive findings and all seven were positive to the x-ray. All showed a positive reaction to Tebeprotin and one was influenced by treatment. Five of his cases had cataract and all showed corneal deposits and vitreous opacities.

Heine agrees with Koby that it is impossible to differentiate this condition from proved cases of tuberculous iridocyclitis. Heine studied ninety cases of heterochromia, fifty-six of which were of Fuchs's type. He believed the heterochromia was followed by cyclitis. Lutz, however, examined nearly one hundred cases and found no evidence of tuberculosis in any of his cases. He considered it a degenerative process and the depigmentation not the result of uveitis but preceding the pathological process that develops in the lighter eye. He was inclined to agree with Gowers, that the process was an abiotrophy or "the inability of the eye to compensate regeneratively for the wear and tear on the tissues of the ordinary life process." He concluded that heterochromia always was the result of a unilateral inheritance, whether due to a depigmentation or an inhibition of pigmentation or was congenital and that in the complicated cases, in the development of the eye, certain hereditary determinants were incompatible, causing vaso-motor disturbances that produced cataracts and postcorneal precipitates.

Posttraumatic heterochromia has been described by Vogt and Koby. The injured eyes showed a darker pigmentation than the normal, developing in the superficial layer of the iris. Naevi were usually present and the iris tissue showed atrophy. Koby states that posttraumatic heterochromia establishes itself in about ten years and is due to hemorrhage or prolonged hyperemia. It may also follow operations for congenital cataract.

The case here presented, associated with cataract, cyclitis, and depigmented iris, belongs to the type that is secondary to inflammatory processes and cervical sympathetic disturbance.

The patient was a white male of forty-six years. His parents had died at about the age of sixty, cause unknown. He had three sisters living and well and was the father of three children. He had had the usual diseases of childhood and suffered a fractured femur at the age of ten. Fifteen years ago he had had malaria and had had attacks of influenza at different times. There was no history of any operations and he had enjoyed good health most of his life. He had never suffered any pain in his head, nor in his eyes, nor was there history of any eye trouble until a few years ago, when he consulted an oculist complaining of poor vision in the right eye. At that time the pale iris, lenticular changes, and vitreous opacities were noted.

The general physical examination revealed no pathology. The nose and throat examination was negative but x-ray films of the sinuses showed some right frontal thickening. X-ray pictures of the chest did not show any evidence of tuberculosis but the tuberculin test was slightly positive. Wassermann and urine tests were negative. Cultures from the right conjunctiva showed Bacillus subtilis to be present. The external examination of the eyes revealed a slight ptosis of the right upper lid and a pale-blue iris on the same side, while its fellow was brown. The tension was normal and the rotations were full and free in all directions. The pupils were round but slightly unequal, the right one being somewhat smaller, but both reacted normally to light and accommodation, and consensually. The anterior cham-

bers were of normal depth and the tear sacs were clear. By oblique illumination and the loupe, a dense cataract with but little iritic shadow was seen in the right eye, while the left eye was negative. No fundus examination was possible in the right eye. The left showed a normal brown iris with a few fine opacities in the lens and vitreous. The disc was oval and of good color, the edges sharp, and the vessels and fundus were normal.

Slitlamp examination of the right eye showed a few colorless precipitates on the posterior surface of the cornea, more or less limited to its lower part. The anterior chamber appeared to be clear. The iris looked dull and somewhat atrophic and a few, small, nodular swellings were observed. The pupillary border was normal and no synechiae were present. A dense cataract was seen with striations on the capsule.

A combined extraction was performed, using a conjunctival bridge, and the patient made an uneventful recovery with good vision, with correction, in the right eye.

Cataracts without precipitates occur in heterochromia but as a rule they appear between the ages of ten and twenty. The lighter iris is the more seriously affected, the trabeculae, crypts, and furrows are less discernible and the iris has a dull feltlike appearance. Changes in the pigment layer are severe and typical of the disease. Sections of the iris have shown an increase in the size of the nuclei in the iris stroma and an increase in connective tissue with some mast cells and lymphocytes but no polymorphonuclears. Hyalin was seen around the vessels. Costi found vacuole formation in the cells of the pigment epithelium of the iris and ciliary body. The iris changes vary from transitions of uveitis to atrophy and the cyclitis is different from that usually observed.

A severe cyclitis does not always produce cataract and even the common mild variety rarely does so, but the slow, chronic, slight cyclitis of heterochromia almost always produces a cataract. Some determining factor causes this change in the lens and it is probably the same etiological agent that causes the heterochromia. At any rate, the pigment either fails to develop in the lighter eye or depigmentation takes place, and it is either hereditary, inflammatory, or sympathetic, or a combination of two or of all of these.

St. Luke's Hospital.

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STEATOSIS BULBI WITH SPECIAL REFERENCE TO THE CORNEA

THEODORE M. SHAPIRA, M.D.
CHICAGO

Primary fatty metamorphoses in the eye are rare; those secondary to other ocular pathology are more common. In the writer's first case it appeared in a patient with secondary glaucoma after extracapsular cataract extraction. The anterior chamber was found to be lined with an epitheli ' layer. An unsuspected intraocular foreign body, which probably ruptured the lens and induced severe intraocular hemorrhage, gave rise to steatosis in the second case. Read before the joint annual meeting of the Southeastern German Ophthalmologic Society and the German Ophthalmologic Society of Czechoslovakia, February, 1933, in Breslau, Germany. The writer was an honorary assistant in the German University Eye Clinic, Prague, Czechoslovakia under the directorship of Dr. A. Elschnig.

The two cases reported here represent fatty degenerative processes in the anterior section of the bulb following other ocular pathology. The first case reported is of interest in that it is associated with glaucoma caused by epithelial cysts in the anterior chamber following cataract extraction. The second case is of interest in that an intraorbital foreign body unknown to the patient or to his parents, was disclosed by roentgen-ray examination.

Fatty degeneration, according to Dellafield and Prudden, is the formation of fat at the expense of the cell substance and differs from fatty infiltration in that the fat is not formed by synthesis out of materials brought by the cells and stored within it, but is formed by conversion of the cellular proteids, the cell being partially or completely destroyed. Since there has been some misunderstanding as to the exact nature of the process in many instances, the term "fatty change" has been employed to include either or both processes. Jaensch, in his studies on fatty degeneration of the cornea, ventures that there may be "fatty decomposition" present.

We know that these fatty changes may be primary or secondary. Cases reported of primary fatty metamorphosis are rare, comparatively few being reported in the literature. Gerontoxon is a primary fatty degeneration but according to E. Fuchs, it is a physiologic fatty degeneration. That this is a physiologic process is borne out by de Schweinitz who says that its presence appears not to interfere with the healing of wounds. In cataract extraction, for example, A. Elschnig states that gerontoxon is not a contraindication for operation, provided a careful differential diagnosis has been undertaken. Gerontoxon is described as appearing in normal corneae as a result of senile degeneration. Earlier pathologists disagreed as to the exact nature of the process and since the corneal tissue did not stain with osmic acid, but did stain with sudan III, Collins and Mayou concluded that it must be regarded as a form of fat which did not stain with osmic acid.

There are two types of the pathologic fatty changes, a marginal fatty degeneration and a central fatty degeneration. To the former class belong the following cases of Kamocki, H. H. Elschnig, Meesmann, Vannas, and Katz and Delaney.

In 1893, Kamocki reported the first case of primary fatty degeneration of the cornea. It occurred in a 42-year-old female and was confined to the periphery. Histologic sections showed unaltered epithelium, an absence of Bowman's membrane in places, and dilated intralamellar spaces which contained large swollen cells. These, according to the author, were degenerated fat cells whose origin probably was from fixed corneal corpuscles.

In 1923, H. H. Elschnig reported a case of primary fatty degeneration of the periphery of both corneae extending over the limbus in a 58-year-old man. General examination and Wassermann reaction were negative. Ten months later, on admission for cataract operation, the yellowish masses were gone and in their stead, a smooth scar

remained. The cataract extraction was uncomplicated. At this time the blood cholesterol was normal. Elschnig concluded that this process was a local fatty degeneration.

In 1927, Meesmann described a case of unilateral primary fatty infiltration of the cornea in a 29-year-old woman. This process was localized in the posterior third of the cornea, the anterior two thirds and the epithelium being normal. The process was three years old and was associated with a definite increase in blood cholesterol.

In 1931, Vannas described a case of primary fatty degeneration of both corneae in an 84-year-old female. The degenerated tissue was white, ring-shaped, and localized in the corneal periphery. The changes were confined to the anterior corneal lamellae; the epithelium was unchanged. Blood cholesterol was normal.

In 1933, Katz and Delany reported a case of primary fatty infiltration of the corneal periphery in a 53-year-old man before the American Ophthalmological Society. In a personal communication, Katz stated that Bowman's membrane contained much fat as did the epithelium and corneal stroma, especially in the middle and posterior layers of the latter. The perivascular areas contained many fat-laden histiocytes.

To the central type of fatty degeneration of the cornea belong the following cases of Tertsch, Takajasu, Bachstetz, Kusama, and Meyer.

In 1911, Tertsch reported a case of primary fatty degeneration of the cornea. It was a bilateral affair and appeared in a 32-year-old farmer. In this case, the central areas were opaque and were composed of the degenerative processes, the periphery remaining comparatively clear. The condition was almost symmetrical. Since all examinations as to the etiology of the process were negative, Tertsch concluded that fat originated from a reserve supply, so called, which had its source in the direct destruction of the corneal lamellae. Bowman's membrane, epithelium, and the superficial corneal layers were much altered; Bowman's membrane contained no fat.

In 1912, Takayasu reported two cases of primary fatty degeneration of the cornea, both localized in the pupillary areas. The first was in a 16-year-old girl. There is some doubt as to whether these cases can justly be classified as primary, in view of the fact that both patients had previously had trachoma. The author says that deficient corneal nutrition is the cause of the degeneration.

In 1921, Bachstetz published a case of bilateral primary fatty degeneration of the cornea in a 36-year-old male, with beginning Basedow's disease. The fatty process was of three years' duration in the left eye and one year's duration in the right eye and was localized in the parenchyma of the central areas. Bowman's membrane was almost intact, but contained fat droplets and the superficial layers were much altered. As to the etiology, the only significant observation was the fact that the blood cholesterol was at the upper limits of normal.

In 1921, Kusama reported a case of primary unilateral fatty degeneration in a 55-year-old female. The center of the parenchyma was the seat of the process because, stated the author, it was farthest from the limbal vessels. Bowman's membrane was little changed, but did contain a few fat cells.

In 1928, H. Meyer described a case of primary xanthosis of the cornea in a 65-year-old female, which was confined to the center. Histologic section showed fat globules in Bowman's membrane and in the corneal lamellae which were separated in places so that the fat droplets became confluent. Meyer concluded that the process was endogenous; either due to changes in the corneal tissue itself or in the body as a whole.

As to the etiology of the above-mentioned cases of primary fatty changes in the cornea, nothing definite was established by the various authors. Many have tried to link the process with an increase in blood cholesterol, but this has failed in all except Meesmann's case.

Secondary fatty changes in the cornea are common. Studies on keratomalacia, which sought to determine the

etiology of the disease, gave much impetus to further study of fatty changes in the tissue. Early workers as Uhthoff, Axenfeld, and von Hippel attributed the corneal changes to primary bacterial invasion, but this theory was soon discarded for the universally accepted one of nutrition or vitamin-A deficiency. Corneal changes were produced by means of dietary deficiences by Rumbaur, who produced an ophthalmia in rats. Mori also produced the disease in rats. Goldschmidt and Holm likewise arrived at similar conclusions and the findings of all these workers were identical with those encountered in the human cornea. Blegvad reported a case of xerophthalmia, keratomalacia and xerosis conjunctivae which was healed in three weeks by means of a diet rich in cod-liver oil (fat-soluble vitamin A). Others attempted by means of varied dietary deficiencies to produce similar corneal changes. McCollum, Simmonds and Becker reported an ophthalmia occurring in rats fed on diets rich in fat-soluble vitamin A, but containing different salt mixtures. These findings, however, have never been corroborated.

Recent and quite thorough work on fatty changes in the cornea has been done by Jaensch. He examined histologically the eyes of two children both affected with keratomalacia. One was markedly undernourished, the other was very well nourished. He demonstrated that the greatest degree of fatty degeneration occurred in the central area of the cornea, especially the deep parenchyma. This he explains is due to the distance of this area from the source of nutrition; namely, the limbal network of vessels. The cornea, he showed, underwent a cellular infiltration consisting for the most part of leucocytes, followed by cell destruction and fatty degeneration; the fat originating from the disintegrated corneal cells. The leucocytes are later replaced by lymphocytes and large monocytes, which he calls lipoid phagocytes. Brückner states that the phagocytes in these fatty processes are cells derived from the corneal endothelium. Jaensch also studied fatty changes in the cornea in cases of herpes zoster corneae, keratitis neuroparalytica, and keratitis due to lagophthalmus.

Bachstetz observed fat droplets in a case of exfoliative keratitis and he stressed the similarity clinically and histologically between this disease and keratomalacia. The fatty degeneration, he concluded, was due to a toxic injury of the cornea, which became so weakened as to allow bacteria to enter later.

Nakaizumi reported fatty degeneration in ten cases of parenchymatous keratitis. Axenfeld demonstrated fat droplets in conjunctival epithelium from a case of xerosis. Fatty changes in corneal epithelium are seldom observed, according to Treacher Collins, although Attias reported a case of fatty degeneration in scales of corneal epithelium thrown off in exfoliative keratitis in an eight-week-old infant.

Karsner states that degeneration terminates in either hyaline, calcareous, or fatty processes, but the circumstances determining the particular type are unknown. All three types have been described in the cornea, the calcareous type being more common than the other two. Pathologists suggest that fatty changes result after interference with nutrition over a long period of time. That the fatty change may take place in the cornea regardless of the duration of the underlying pathologic process is shown in a case cited by Jaensch, in which, two weeks after a dynamite injury with resultant panophthalmitis, exenteration was performed and histologically fat droplets were found in leucocytes and connective-tissue cells of the superficial layers of the corneal parenchyma. The case of Attias, cited above, also stresses the possibility.

I have had the opportunity of studying two cases of fatty degeneration, both secondary.

Case 1. In 1926, the left lens was removed from a 66-year-old male by Professor Elschnig, who performed a simple extracapsular extraction. The convalescence was somewhat prolonged by the appearance of a light iritis and four weeks after the extraction, there appeared in the inner upper corneal segment, on the posterior surface, a fine grey

opacity which in a short time became more extensive. The former vision of 6/8 with correction, decreased rapidly while under treatment in another clinic. On May 9, 1927, the patient came with an incompensated glaucoma, tension 40 mm. of mercury, vision 1/12. A fine grey opacity was present on the whole posterior surface of the cornea, the anterior chamber was deep, and the iris discolored and almost smooth, as far as one could observe through the opaque cornea. Prof. Elschnig diagnosed secondary glaucoma due to an epithelial clothing of the whole anterior chamber and on May 10, 1927, the iridectomy performed confirmed the diagnosis.

Histological Examination: The section of iris, figure 1, obtained by the iridectomy, was stained with haematoxylin eosin. Incidentally capsule remains, with morgagnian spheres, were also visible.

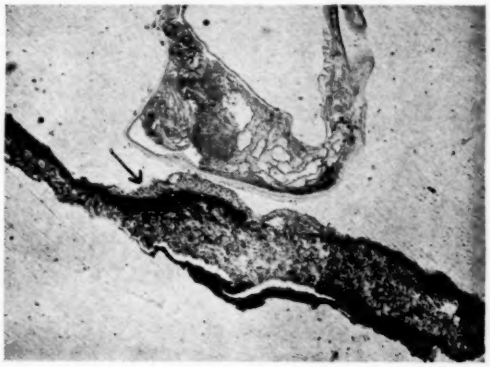

Fig. 1 (Shapira). Case 1. Section of iris obtained by iridectomy from the patient's left eye.

The section shows a very atrophic iris, irregularly thinned. The pigment layer is missing in places. The anterior portions of the iris contain much pigment deposited within the iris tissue and many clump cells. This pigmented stratum is browner than the posterior layer which is almost black. Throughout the stroma are visible many chromatophores and pigment-clump cells. The iris vessels are also hyalinized. Covering the anterior surface of the iris is a layer of epithelial cells, irregularly displaced and thicker toward the center of the surface. This layer of epithelium lies like a thin veil over the iris surface, hindering the so-called absorption phenomenon of this tissue.

In spite of x-ray treatment the eye slowly became blind, without a decrease in the tension. On May 11, 1928, the patient entered the clinic and the far-advanced cataract of the right eye was extracted intracapsularly and with round pupil, by Prof. Elschnig. Within two months his vision with correction was 6/4; convalescence was normal.

On May 10, 1932, the patient was admitted again to the clinic, and the following observations were made on the left eye:

Fig. 2 (Shapira). Case 1. Section from the enucleated left eye, showing epithelial cyst in the anterior chamber enclosing fatty material and cholesterin crystals. Scarlet-red stain.

The conjunctiva was slightly reddened and edematous. The conjunctival and episcleral vessels were tortuous and injected. The cornea was slightly oval horizontally and irregularly convex in the upper half. The tissue was completely opaque and coarsely and finely stippled. There were many superficial, newly formed vessels of a branching character running over the limbus from the injected limbal vessels. In the deeper layers, larger vessels from all sides extended to the central area. Extending from the nasal limbus to the center was a yellowish mass situated deep, with a nuclearlike structure, denser in the upper, inner quadrant. The yellow mass had an "H"-like appearance

It was possible to see through only the temporal part of the cornea. No anterior chamber was present and in the iris were embedded crystals of a greyish-yellow substance.

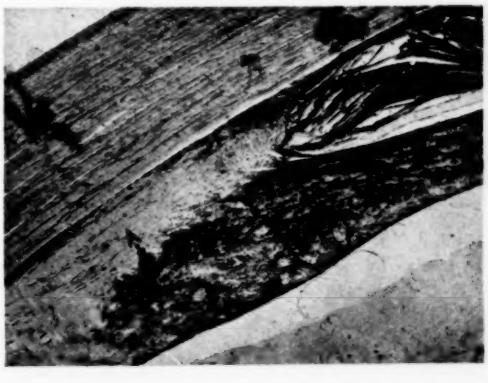

Fig. 3 (Shapira). Same section as shown in figure 2, stained with neutral red. A, solid mass of epithelial cells.

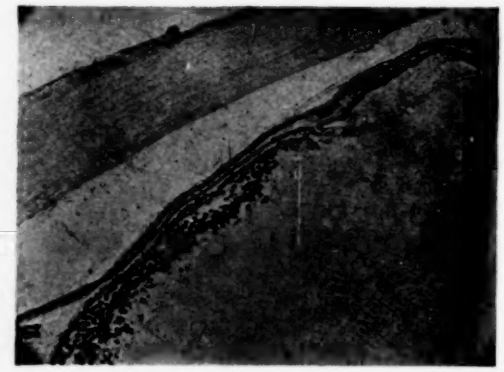

Fig. 4 (Shapira). Case 2. Section from the enucleated right eye. Iris, choroid, and retina are not involved by the degenerative process.

Prof. Elschnig enucleated the left eye and 4 days later the patient was discharged.

Sections of the anterior part of the bulb were stained with haematoxylin eosin, osmic acid, scarlet red, neutral red and sudan-III. The epithelium, except for its irregularity was little changed. Immediately below the epithelium and especially in the limbal region was situated a new-formed tissue in front of Bowman's membrane. This pannus tissue consisted of fibroblasts with elongated nuclei, between which were occasional lymphocytes. Many distended vessels were also visible. The corneal stroma except for occasional cells was practically normal. In the limbal region above, the postoperative scar tissue was visible with the discontinuity of Descemet's membrane, otherwise the latter was normal. The anterior chamber was spindle shaped and filled with exudate, leucocytes and fibrin. The contents took the fat stain especially well in the chamber angle. Figure 2 is a scarlet-red-stained preparation showing a huge epithelial cyst in the anterior chamber which encloses much fatty material and many cholesterin crystals. In other sections, multiple epithelial cysts are seen, appearing as solitary islands. The iris is also atrophic and contains much fat especially in the sphincter regions. Figure 3 shows the same section stained with neutral red, but further toward the periphery is a solid mass of epithelial cells (A).

Case 2. This 15-year-old boy entered the eye clinic on November 9, 1931. His father stated that seven years previously, the boy had been struck in the right eye with a hammer. Immediately afterwards, he saw nothing with this eye. On examination the right eye was amaurotic. The left had 6/6 vision and he read Jaeger 1 without correction.

Examination of the right eye showed: Bulbus: pale, nonirritated. Cornea: From all sides, especially in the region of the limbus, superficial and semideep vessels ran into the cornea for about one millimeter. Horizontally oval, on the upper and lower circumference, uveal pigment was adherent to the posterior corneal surface. Farther, this pigment was somewhat orange colored. At "6 o'clock," a triangular mass pointed toward the corneal center and consisted partly of crystals with hemorrhagic pigment. At "9 o'clock" were clear, crystal plaques, some of them entirely blood tinted and irregularly placed. Deeper in the cornea, grayish white filaments were seen. Diascleral illumination was obstructed. Deeper structures could not be seen.

Slitlamp examination of the cornea by Prof. Dr. J. Kubik revealed a glistening epithelium. Medially in the region of the palpebral fissure, small white masses in a hammock form were seen subepithelially, running from the limbus through a clear corneal zone. A completely thinned, superficially placed, white opacity was also seen in the region of the palpebral fissure. The cornea appeared to be much thinned. Its curvature was normal. From the limbus on all sides, ran deep, humped vessels especially from above; here and there a superficial vessel was seen to intermingle with the limbal vessels. On the posterior corneal surface was a nuclear, yellowish-orange crystalline mass, which in the denser area looked reddish brown and could be distinguished only by oblique illumination. With direct illumination, the whitish-yellow crystals were seen best. In the contents of the anterior chamber, which was finely milky opaque, floated yellowish-gold, glistening bodies and scales, irregular in form. Here and there were conglomerated ball-shaped bodies. With each lid closure, these masses changed their position. Regular convection heat currents were not seen. The anterior chamber gave the impression of having contents of a very viscous nature. Deeper section of the bulb could not be seen.

The left eye was normal in all respects. On November 11, 1931, roentgen-ray examination showed an intraorbital metallic foreign body, probably buck shot, in the right eye. On November 19, 1931, the right eye was enucleated by Dozent Dr. Stein.

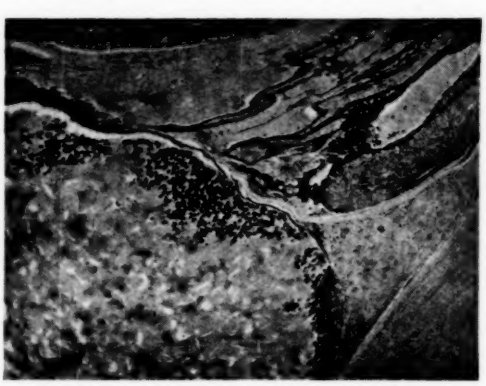

Fig. 5 (Shapira). Case 2. Region of the angle of the chamber. Fat droplets in large numbers. Note long ciliary processes. Sudan-III stain.

After an uneventful recovery the patient was discharged four days later.

Histopathological examination: Sections of this bulb were also stained with haematoxylin eosin, osmic acid, sudan-III, and scarlet red. The corneal epithelium was but little altered. The stroma was diffusely infiltrated especially the posterior layers. The anterior chamber was completely obliterated with lens material, vitreous, leucocytes and fibrin. The fat droplets were very pronounced in this case and were localized at the periphery of this semifluid substance. It is interesting to note that the fat droplets were not to be seen within the center or thereabouts of the mass. In figure 4, iris, choroid and retina seem to be free from this degenerative

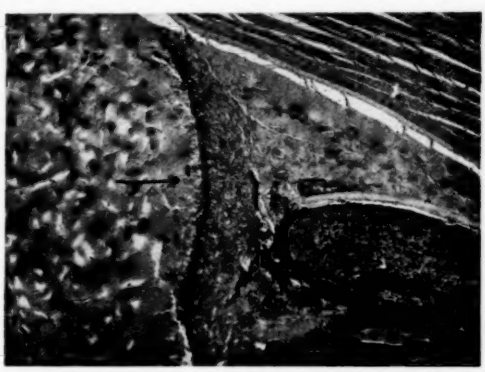

Fig. 6 (Shapira). Case 2. Distended cells with large deep-staining nuclei. Haematoxylin eosin stain.

process. Figure 5 shows a sudan-III stain in the region of the chamber angle. The vast amount of fat droplets is remarkable. This section also shows extremely long ciliary processes. Figure 6 is a haematoxylin eosin preparation showing huge distended cells with large, deep-staining nuclei. These cells may be lipoid phagocytes. The protoplasm is faintly granular and darker toward the periphery of the cells. Surrounding the oval nuclei is a halo area of lighter staining protoplasm.

In the first case the fatty degeneration appeared in an eye with secondary glaucoma after epithelial clothing of the anterior chamber, as a complication of a prolonged healing of the wound after a simple cataract extraction. In the second case, the fatty degeneration appeared as a result of a serious trauma which doubtlessly ruptured the lens and brought on a very severe intraocular hemorrhage.

In closing we are especially interested in several questions.

1. What is the origin of the fat in these processes?

According to Kawamura there are many possibilities: (a) There may be a physiologic reserve under the influence of the organs of internal secretion, especially the adrenals. (b) There may be a cholesterinemia. (c) There may be a decrease in the vitality of the cells, so that the already normal cholesterin compounds in the tissue fluids and secretions cannot be decomposed. This is probably the case in all secondary fatty degenerations and also in our two cases. (d) There may be an increased activity of the cells of the reserve, for example as in a genuine xanthoma, in which case we are dealing with living cells. According to Jaensch, the fat may originate from an autolytic process, an intraocular exudate, a bacterial toxin, a fatty decomposition, or a phagocytic process.

2. What types of fat do we find?

In almost all cases which were chemically examined, glycerinester, cholesterinester and cholesterin fatty acid were found.

3. What part does cholesterin play?

It is believed that in the presence of a lipemia, the fat passes into the blood stream and into the tissues. The part played by cholesterin is not entirely clear, although it probably serves as a vehicle in the transportation of the fat. Katz and Delaney examined two cases of cholesterinemia with the slitlamp and found no fatty changes in the cornea, in spite of the fact that the blood cholesterin was twice the normal in one case, and three times the normal in the second case.

4. What is the origin of the phagocytes in the cornea?

According to Brückner, as stated above, they originate from the corneal endothelium. Katz and Delaney believe that they may originate from four sources: (a) from the tissue encircling the corneal stroma; (b) from the blood stream; (c) from the blood-vessel walls, especially the adventitia; (d) from the cell elements of the corneal stroma.

Many authors believe that the phagocytes present in a primary fatty degeneration of the cornea are a product of the corneal stroma. In secondary fatty degeneration of the anterior section of

the bulb, as in our two cases, it is most probable that they originate from the adventitia of the blood vessels.

I wish to thank Prof. Elschnig for his permission to publish these cases and for his help in the preparation of this paper.

58 East Washington Street.

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CHANGES IN REFRACTION WITH HYPERGLYKEMIA

Report of a Case

R. N. BERKE, M.D.
HACKENSACK, NEW JERSEY

Changes in refraction are occasionally the first symptom of a diabetes and if myopia appears, diabetic treatment should be instituted at once because of the high mortality that occurs in such cases. The writer's case of myopia in diabetes made a quick change to hyperopia under insulin treatment.

The occurrence of refractive changes in diabetes mellitus has been known for many years. Horner[1] in 1873, is given the credit of having been the first to report a case of acquired hyperopia in diabetes. Since that time some 78 cases have been reported. In 1925, Duke-Elder[2] in a very excellent article, reviewed the literature, collecting 45 reported cases, to which he added three of his own and two reported to him, bringing the total of reported cases to 50 at that time. Of this number, 15 (30 percent) were myopic, 20 (40 percent) were hyperopic, 8 (16 percent) showed both myopic and hyperopic changes and 7 (14 percent) were anomalous cases, lacking sugar reports, or were associated with ocular disease. In 1926 Dykman[3] cited four cases with hyperopia, one of which was that of a 23-year-old girl, who required a +1.25 D. sphere added to her distance glasses for reading. This failure of accommodation he attributed to a probable involvement of the ciliary muscles, though apparently no record of the near point of accommodation was made. In the same year Post[4] added two case reports, one of which presented both myopic and hyperopic changes, the other showing only an increase in hyperopia. Spalding and Curtis[5] in 1927 studied 307 successive diabetics and reported two cases as having temporary blurring of vision for distance, either on admission or after insulin therapy. They failed to state whether these cases presented hyperopic or myopic changes. In 1928, Burch[6] reported a case in which both myopic and hyperopic changes occurred. In the same year, Gifford[7] mentioned two cases of transitory increased hyperopia accompanying diabetes. In 1930 Oreneal[8] cited one case of diabetic hyperopia and one case showing both myopic and hyperopic changes. The following year Maxwell[9] reported five cases of diabetic hyperopia. In 1932, Geiger and Roth[10] reported two cases of transitory presbyopia which they attributed to paresis of accommodation accompanying diabetes, and three cases showing diabetic hyperopia. In the same year McGrath[11] reported three cases showing hyperopic changes and Greeves[12] two cases showing myopic changes attributed to diabetes mellitus.

Since Duke-Elder's paper in 1925, 28 diabetic cases showing refractive changes have been published. Of this number, 2 were purely myopic (7 percent), 18 (64 percent) were hyperopic, 3 (11 percent) showed both myopic and hyperopic changes, 2 (7 percent) had to be classed as anomalous because of insufficient data and 3 (11 percent) were diagnosed as due to changes in the ciliary muscles.

When this series of 28 cases is compared with the 50 cases reported by Duke-Elder in 1925, some very interesting facts come to light; namely, a marked decrease in the percentage of myopia (from 30 percent to 7 percent), and a great increase in the percentage of hyperopia (from 40 percent to 64 percent). With this comparison in mind, it is interesting to note that Von Noorden[13] stated in 1912, that myopic changes in refraction in diabetes were common (4.4 percent of all diabetics as quoted by Joslin[14]) while hyperopic changes were rare. This discrepancy is doubtless due, at least in part, to the introduction of insulin (1921) in the treatment of diabetes, and is a fulfillment of the prophecy made by Duke-Elder in 1925, to the effect that the future would doubtless witness an in-

crease in the number of hyperopic changes in diabetes.

The percentage of diabetic patients manifesting refractive changes seems to vary with the statistician. Von Noorden in 1912, as quoted by Joslin, found 4.4 percent of refractive changes in 477 consecutive diabetics, all of these refractive changes being myopic. Spalding and Curtis[5] in 1927 found only .65 percent of refractive changes in 307 consecutive cases of diabetes. Burch[6] quotes Anderson as finding 14.6 percent of transitory refractive changes in 292 patients with diabetes. Grafe[15] refuses to cite statistics on 1200 diabetics seen by him because of the great variations present in all statistics.

An interesting fact in connection with the myopic refractive changes in diabetes is the high percentage of deaths recorded for this group. Out of the 17 myopic cases reported, 5 or about 30 percent terminated in death. This is in marked contrast to the hyperopic group of 61 cases in which no deaths occurred. All of these myopic patients died before the advent of insulin except Duke-Elder's case of a 21-year-old girl who developed —13 D. of myopia and died on the eighth day in the hospital, in spite of insulin and general diabetic treatment. Myopia developing in diabetes, therefore, is of bad prognostic significance and calls for prompt and energetic diabetic treatment.

The usual clinical history of a diabetic patient presenting myopic changes of refraction is something like this: A person with apparently perfect vision suddenly, or within a few days, develops poor distance vision and presents other general symptoms and findings indicative of diabetes. Upon examination of the urine or the blood, an increased amount of sugar is noted. Examination of the refraction reveals a varying amount of myopia, the average being 2 to 3 D., though Duke-Elder has reported a case of —13.00 D. in one eye and —14.00 D. in the other. The average age is 46 years, the extremes being 14 and 69. Twelve of the 14 reported cases were in women. Unless treated, the myopia increases and the patient may go on to diabetic coma and death. Often the first sign of diabetes definitely noted by the patient, is impaired vision for distance, reading vision being unaffected. For this reason the ophthalmologist should be on his guard when such symptoms are presented.

The clinical history of a person presenting the usual transitory hyperopic refractive change occurring in diabetes mellitus is something like this: A patient, who has known for some time that he has had diabetes, pays a visit to his family physician who discovers a high blood sugar. The patient usually has no complaints relative to his vision at this time, but after a few days on a strict antiketogenic diet or especially if under energetic insulin therapy, he complains that his distance vision is blurred and that he can not see to read with his reading glasses. Then he makes the interesting observation that he can see better for distance with his reading glasses, a phenomenon which seems strange to him since his reading glasses always produced marked blurring for distance before. His oculist finds that he has developed 2 to 3 D. of hyperopia since last tested. In a few weeks or months the patient is able once more to go back to wearing his old glasses with comfort, no permanent ocular damage apparently having occurred.

These transitory refractive changes have been attributed by Duke-Elder to swelling of the lens in myopia and to shrinkage in hyperopia; they depend on and vary with the sugar concentration in the blood and presumably in the aqueous. Adler[16] has suggested that an increase of the sugar concentration in the aqueous over and above the normal ratio existing in health between the aqueous and the vitreous may account for the myopia and a reversal of this relationship for hyperopia.

Case. Mr. E. Y., aged 38 years, first came for examination on April 23, 1932, complaining of occasional headaches. He stated that his vision for both near and far was good. He had never had pain or inflammation in his eyes or any injury to them.

Vision: O.D., 6/6; with glasses +.25 D. sph. ⊖ +.25 D. cyl. axis 90°, V. = 6/6 —1;

O.S., V. = 6/6; with glasses +.25 D. sph. ⊂ +.25 D. cyl. axis 90°, V. = 6/6—2.

Near point of accommodation measured from the supraorbital ridge, with correction was:

O.D. 17 cm.; O.S. 16 cm.

This gave an apparent range of accommodation of 5.88 D. in the right eye and of 6.25 D. in the left.

External examination, extraocular muscle examination, rough perimetric field examination, and ophthalmoscopic examination were essentially negative for pathology in both eyes.

The patient accepted under homatropin and cocaine cycloplegia:

O.D. +.25 D. sph. ⊂ +.75 D. cyl. axis 105°, V. = 6/5.

O.S. +.25 D. sph. ⊂ +.75 D. cyl. axis 75°, V. = 6/5.

Three days later he returned for a post-cycloplegic examination, accepting:

O.D. +.75 D. cyl. axis 100°.

O.S. +.75 D. cyl. axis 80°.

This correction was ordered for constant use.

Six months later he returned complaining of blurred distance vision; reading vision, he said, being perfect. Four or five days before reporting, he had noticed that he could not see clearly beyond about six feet, the next day not beyond three or four feet and on the day of examination, not beyond arm's length. When questioned about his general health, he said he had not been feeling so well of late, and that he had lost about twenty pounds in the last six months. This had been more noticeable a few days before examination, during which time he had been losing about two pounds a day. He had been drinking about four to six quarts of water daily and had an insatiable appetite for sweets. His family physician reported a 4+ sugar in the urine. An acetone breath was noted.

Examination of his eyes showed:

Vision: O.D. 6/20; with +.75 D. cyl. axis 80°, 6/20—1

O.S. 6/20; with +.75 D. cyl. axis 100°, 6/60—

Near point with correction was: O.U. 12 cm., equal to an accommodative power of about 8.33 D. in each eye, an increase apparently in the range of accommodation over that present at the last visit, of 2.45 D. in the right eye and 2.08 D. in the left.

A —2.00 D. sphere added to his correction improved his vision to 6/6— in each eye.

Examination of the lids, conjunctiva, lacrimal sac, intraocular tension to fingers, extraocular muscles, rough perimetric field test, cornea, pupillary reactions, media and fundus was essentially negative for pathology except for moderately contracted pupils.

A 1-percent solution of euphthalmine was placed in each eye for dilation of the pupil. It produced no appreciable effect. This was followed by one dose of 2-percent homatropine, which dilated the pupils sufficiently to afford a satisfactory view of the fundus. A diagnosis of diabetic myopia was made.

To determine what effect, if any, cycloplegics might have on this myopia, four drops of a 4-percent solution of homatropine were placed in the right eye only, at five-minute intervals, the left being used as a control. In half an hour the distance vision was found unchanged. Four drops of a 2 percent atropine-sulphate solution were then placed in the lower cul-de-sac of the right eye at five-minute intervals and the distance vision taken in one hour. Again no appreciable change was noted. However, the near point of the right eye was moved from 12 cm. (8.33 D.) to 24 cm. (4.16 D.)—a change of about 4 D. due to the cycloplegia, the chief effect of which was to reduce the amplitude of accommodation about 4 D.

Both eyes were tested for refraction, the right under atropine cycloplegia and the left under no cycloplegia, the correction being:

O.D. —1.00 D. sph. ⊂ —1.00 D. cyl. axis 10°, V. = 6/6

O.S. —1.50 D. sph. ⊂ —.75 D. cyl. axis 170°, V. = 6/6

By transposing this prescription the myopic change is more readily appreciated, when compared with the original correction:

O.D. —2.00 D. sph. ⊂ +1.00 D. cyl. axis 100°

O.S.—2.25 D. sph. ⊂ +.75 D. cyl. axis 80°

This represents a change of about a —2.00 D. sphere in the right eye and about a —2.25 D. sphere in the left. Had the latter been placed under cycloplegia, doubtless the +.25 diopters of latent hyperopia present would have become manifest and the sphere in this eye then would have been the same as that in the right.

A change of .25 D. occurred in the amount of astigmatism present in the right eye, while that of the left remained constant. No change in the axis occurred.

It is evident that these myopic changes in the refraction of the two eyes did not affect appreciably the range of accommodation, but only its position, the near and far points being moved closer to the eye.

The patient was referred to Dr. L. A. Young who submitted an essentially negative report except for a 4+ (5 percent) urinary sugar and a blood sugar of 182 mg. per 100 c.c. on the second day—forty units of insulin having been given on admittance.

Unfortunately the blood sugar was not tested before the first dose of insulin was given, hence we have no means of knowing what the blood sugar level was at its highest point. However, it is safe to assume that it must have been above 200 mgm. per 100 c.c.

No record was made of the near points or the distance vision while the patient was in the hospital, to gauge the rate of disappearance of his myopia. However, he stated that his distance vision became normal after the first injection of insulin. For a few days after this, his near vision was poor but at the

end of a week both distance and near vision were "perfect."

On November 25, 1932, one month after leaving the hospital he returned for a check-up on his glasses and ocular condition. He had been on a diet since his discharge and his urine had been sugar free. He was "feeling fine."

With a manifest refraction he accepted three-quarters diopters more sphere in each eye, the correction being:

O.D. +.75 D. sph. ⊂ +.75 D. axis cyl. 80°, V. = 6/6

O.S. +.75 D. sph. ⊂ +.75 D. axis cyl. 100°, V. = 6/6

On February 10, 1933, 3½ months after discharge from the hospital, he returned again for an examination, saying he felt "better than ever" and that his eyes had given him no trouble since he had left the hospital. Examination was completely negative, relative to his external eye condition, fields, extraocular muscles, and fundi. His refraction was checked again under cycloplegia and found to be exactly the same as on the first visit, ten months before. He had confined himself to the diet outlined for him upon leaving the hospital and had been constantly sugar free since. He could not be induced to have a blood-sugar test.

Comment

The interesting features of this case are the apparently sudden change in the refraction with a gradually increasing blood sugar, the almost immediate improvement of vision on energetic insulin therapy and the shifting of the refraction from myopia to hyperopia after treatment. Doubtless most of these diabetic myopic patients would show a change to hyperopia if the refraction and the near points were recorded daily while under diabetic treatment.

Conclusions

1. Transitory changes in refraction, myopic or hyperopic, occur in diabetes mellitus.

2. Myopic changes occur with increasing sugar concentration in the blood and hyperopic changes with decreasing blood sugar.

3. Myopic refractive changes call for immediate diabetic treatment because of the bad prognosis associated with these cases, one third of all reported cases having died.

4. Moderate doses of atropin or homatropin have no immediate effect on the myopia of diabetes.

50 Anderson Street.

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DETACHMENT OF THE RETINA—ITS PRESENT OPERATIVE TREATMENT

DOHRMANN K. PISCHEL, M.D.
SAN FRANCISCO

Gonin's, Lindner's and Safar's methods of treating retinal detachment are discussed together with a report of the results obtained in treating fifteen cases according to Safar's technic. Six cures were effected. From the Department of Surgery, Division of Ophthalmology, Stanford Medical School.

In discussing the operative treatment of detachment of the retina, I do not intend to go into the question of the etiology of the so-called idiopathic detachment of the retina, or to discuss whether the tear or hole usually found in the retina in cases of detachment comes before or after the detachment, but will proceed on the assumption that those interested in this phase of the subject will have read about it already. The importance of the hole or tear is stressed by practically every man who has studied the subject recently, and all agree that its presence precludes a healing of the process, and that therefore all operative treatment must be aimed at elimination of the hole or tear. What I do wish to present is the impressions I have gathered of the different operations for curing detachment of the retina, which I have seen performed here and abroad.

In the various types of operations, three important features are common to all. They are possibly more obvious to a neutral observer than to any of the operators themselves.

The first is the closing of the hole, or tear, or the sealing it off from the rest of the retina. In all the operations this is done by causing an exudative choroiditis which will glue the retina to the choroid and then by the formation of scar tissue permanently hold it there and obliterate the hole.

Secondly, to accomplish the above, the retina must be brought into contact with the choroid, while the choroiditis is in its exudative stage. This is accomplished by drainage of the sub-retinal fluid. In Gonin's type of operation this occurs through the cauterized hole; in Lindner's operation, through the many trephine openings; in Safar's multiple diathermy puncture, through these holes; in Larsson's operation, by a special trephine opening he makes through the sclera under the detachment.

In the third place, the retina must be allowed to remain quietly adherent to the choroid for some time. This is accomplished by bed rest and immobilization of the eyes by binocular bandage. Here must also be mentioned immobilization of the eyes by stenopeic spectacles.[1] If a patient has only the small holes of the spectacles to look through, there is no temptation to roll the eyes about, and they are thus kept still and are well "splinted." For perfect immobilization Arruga[2] even sews the eye ball to the lower lid by means of a suture through the inferior rectus tendon.

Operations for detachment of the retina fall into three definite types or groups.

The principle of the first type, exemplified by the classical operation of Gonin[3], is the closing of the tear by causing a very localized exudative choroiditis which will seal the tear, or hole. As performed by Gonin, this exudative choroiditis is provoked by inserting through the sclera the red-hot Paquelin cautery. In a similar way others used the galvanocautery. Following the same principle, but using a totally different instrument, Weve of Utrecht perforates the sclera with a fine needle connected with a diathermy current of 75 or 125 milliamperes, using this current to stimulate the choroid to pour out exudate.

The principle of the second group is the walling off of that part of the retina in which the tear is located, from the rest of the retina. The original operation of Lindner[4] and Guist[5] of Vienna accomplished this by making a series of

trephine openings through the sclera around the hole, or holes, and stirring up an exudative choroiditis by touching the exposed choroid with KOH sticks. This caused the formation of a wall of exudative choroiditis around the hole, sealing off the tear from the remaining retina.

Following the same principle, but using entirely different instruments, Safar[6], also of Vienna, produces a wall of choroiditis by putting in a row of fine diathermy needles in place of the trephine openings, the diathermy current used in inserting them stirring up the choroiditis.

In a similar way, Weve[7], of Utrecht, with his single long needle puts a series of diathermy punctures around a hole or area to be walled off. In cases of a tear or disinsertion at the ora serrata he also uses a nonperforating diathermy electrode in the form of a small, 2-millimeter knob or bulb, which he applies to the carefully dried sclera at several points, instead of perforating with the needle, thus causing a rather diffuse choroiditis.

The principle of the third group is that one should endeavor to produce a choroiditis fairly well over the whole area occupied by the detachment. Sven Larsson[8], of Nordenson's Clinic in Stockholm, one exponent of this idea, causes a diffuse choroiditis by using a small bulb electrode attached to a diathermy current, which he applies to the sclera at a large number of points covering the part of the retina in which the hole lies, or covering most of the area involved in the detachment. The detached retina would then be bound to the choroid in a very extensive way.

Another exponent of this type of operation is Sourdille[9], who injects chemical agents under the conjunctiva in an attempt to produce inflammation and adhesion between retina and choroid. As I did not see him, or any of his disciples, at work, I cannot discuss this method at first hand.

Which type of operation has the best success and why? The percentage of cures differs little if one takes the best series of any type of operation. The percentage of cures by different operators, doing the same type of operations, varies tremendously, however. This can best be explained, I believe, by the observation that the more carefully the operator localizes the area to be operated upon, before the operation, the more successful the operation will be. It must be borne in mind that the necessity of careful localization has not been eliminated by these newer operations. Highly *accurate* localization is not necessary, but *careful* localization is still very necessary. As a result of my observations I believe it can be said that localization as practiced by the average man, when he thinks he is being very careful, is about as inaccurate as is compatible with success.

Each type of operation has its advantages, and each its disadvantages, some slight, some great. To compare the types it will be necessary to summarize briefly the technic of each.

Gonin's operation, the best-known specimen of the first type, has been frequently described. Only a few points will be mentioned.

He spends *hours* examining the fundus and localizing the tear. Then at the time of the operation, he again spends the greatest part of the time locating most accurately the point he intended to reach. He may spend as much as forty minutes with this part of the operation. The actual cauterization is quickly done. Having definitely located his point, and marked it with gentian violet, he thrusts in a Graefe knife, withdraws it, perforates again with his fine 2-millimeter (by actual measurement) Paquelin cautery for *one* second, and withdraws. Suturing of conjunctiva completes the operation. Thus Gonin has obtained success in about 50 percent of his cases.

The essential points can be summed up: careful study, painstaking localization, brief cauterization with a *fine* Paquelin cautery.

Weve[7], of Utrecht, also frequently operates according to the principle of Gonin, but with different technic. He uses a very fine diathermy needle, and perforates after very careful localization with his own instrument. Using a current of 60-80 milliamperes he holds

the needle in place, after perforation, for about 3 seconds. He then inspects the fundus and reperforates if he finds he did not exactly strike the tear or hole.

Several other operators, whom I saw, operated as they thought according to Gonin. But none as carefully as he. Each had his own method of localizing which I will not describe. Vogt, in Zürich, used a galvanocautery, but cauterized for 10 to 20 seconds, actually boiling the vitreous. At Gross's clinic, in Budapest, a galvanocautery was used, but localization was careless. At Elschnig's clinic, in Prag, Stein operated and localized fairly carefully, but cauterized the surface of the sclera around the area of the hole and then made two large perforations losing much vitreous and burning for several seconds. Of course, Lindner, when he had formerly been operating according to Gonin, cauterized 5 to 15 seconds, but only after a most careful localization with elaborate instruments.

What are the advantages and disadvantages of this type of operation?

Advantageous is the fact that the armamentarium required is simple. The technic is not complicated, though exacting. The operation is not time consuming. The success of the operation is well proved.

What are the disadvantages? In very brief form they follow: The ultra-accurate localization is a great disadvantage. If one misses the hole by a few millimeters, the operation is a failure. Too prolonged insertion of a hot cautery will allow the retina actually to come in contact with the tip and cause a necrosis of the retina with the formation of new holes. The extensive scarring may cause eventual contraction, and pulling on the retina, with new detachment or new holes. Another point, which I have not seen mentioned before, is that the sudden egress of fluid through the one large hole will cause the retina to be swept to it, so that a part of the retina will be held at this point several millimeters away from the point to which it should have returned, thus putting the retina on the stretch and causing folds and holes. Finally, this method is difficult to use when several holes are present, and impossible in cases of large tears at the ora.

Most of these disadvantages are minimized by the proponents. Some actually are obviated by varying technic. For instance, as Gonin, himself, does the operating, there is no danger of burning the retina and extensive scarring is not the rule. With Weve's single fine diathermy puncture, only the objection to accurate location holds true. And with his instrument for localization this is simplified. Also, he inspects the fundus at once and can reperforate if the location of the first perforation was faulty.

Next I will discuss the second type of operation, that which endeavors to wall off the hole, or the affected part of the retina, from the rest of the fundus. In this group are the Lindner-Guist, the Safar, and Weve operations.

The originator of the basic idea behind these operations is Lindner[4], and I will discuss his modified operation first.

As the technic of the Lindner-Guist operation is fairly well known, I will describe it briefly, only going into particulars about certain new details as yet not published in English.

In cases of single tears, fairly accurate localization is necessary. Lindner, of course, uses the localization apparatus developed at his clinic. The meridian is marked at the limbus by scratching with a knife and then applying India ink or fluorescein. Usually the little localization disc with adjustable arm, which he formerly sewed to the limbus, is not used. A compass may be used to measure the necessary distance from the limbus.

The conjunctiva is widely incised and, with Tenon's capsule, pulled free from the globe. Silk sutures through the conjunctiva and capsule held by artery clamps hanging down over the patient's cheek, nose, chin or forehead, give wonderful exposure. There is no hesitancy in cutting off one or two recti muscles. They are first secured with a silk suture and then cut. Another suture through the muscle stump gives an excellent means of traction to rotate

the globe to unbelievable degrees. Great care is used to stop all hemorrhage and equally great care to avoid obliterating a vortex vein. They believe they have seen sector necrosis of the iris follow this.

When all is dry the trephining starts. The whole course of the trephine openings is first laid out by giving the trephine a few turns at each spot. Then considerable drilling is done at each point. Upon withdrawing the trephine the button is seized and as much of the scleral button as is loose pulled off. The same is done at the next trephine hole, and the next, etc., keeping them all to about the same depth. Then one starts over again at the first, and so on. At the beginning the trephine is given 4 to 5 turns before taking it off and pulling at the button. As the hole gets deeper, only one or two turns are used, then only half a turn. The deeper the hole gets the darker it appears, getting quite gray at the end. Lindner cuts through the last strands or layers with a keratome and does not open the entire hole. He has proved histologically that the action of the KOH passes through several layers, so that it is not necessary to penetrate to the choroid. When all holes are through they are all carefully inspected to see that none bleed. Bleeding here, where it would easily pass into the eye is regarded as fatal to a successful outcome. Guist also carefully inspects the holes to see if any abnormally large choroidal vessels can be made out. If so, this hole is not perforated.

A caustic stick of KOH covered with wax is taken, the wax removed from the tip which is about 1½ millimeters large, and the tip applied to 2 holes for 2 seconds each, then an applicator dipped in 1-percent acetic acid is applied to the holes which are immediately flooded with normal salt solution. It is interesting that while the application of KOH is painless, the patients always squirm or groan as it is neutralized by the acetic acid, which when applied by itself is painless. The rest of the holes are then treated in a similar manner. Then the holes are perforated by thrusting in a fine conical lacrimal punctum dilator. Guist perforates all, Lindner about every third one.

When all bleeding is stopped, muscles and conjunctiva (and Tenon's capsule, if necessary) are sutured, with binocular bandage and bed rest for 8 days. Stenopeic glasses are used for three months afterwards.

There are many advantages to this operation. The KOH applied to the trephine hole causes rather extensive exudative choroiditis. Furthermore localization is fairly easy. Also several holes close together can be surrounded by one circle of trephine holes, or separate holes can be encircled independently. Extensive sectors, and long tears at the ora can be treated. Drainage is through many openings.

What are the accidents and disagreeable features in this technic? Strange to say, the postoperative inflammation is remarkably small. However, the perforations, especially as done by Guist, occasionally cause a tremendous intraocular hemorrhage and the eye is lost. This also has happened as he trephined through the last scleral layer and cut a vessel. If one perforates the choroid during trephining before all the holes are nearly through, the operation must be stopped, as the eyeball collapses unless one has one of Arruga's[2] little plugs to screw in and close the hole. The operation can then be completed some other day.

Lindner[10] has reveloped a newer technic for the walling off operation, which is somewhat simpler. Furthermore, with it one can reach far back to the macula. The principle is the same and exposure and localization are made as before in the Lindner-Guist operation. Then, instead of placing a series of trephine openings about 1 or 2 millimeters apart, he places them about 3 to 5 millimeters apart, surrounding the hole or affected area. Next with a fine spatula placed through the trephine hole, he undermines to the next hole, as in doing a cyclodialysis. The end of the spatula can actually be brought out into the second hole, even when the last fine layer of scleral tissues has not been cut out. In this way it is possible to perforate the holes from the inside.

Thus this newer operation simplifies the technic in two ways: Fewer holes are necessary and only a few of them need be opened entirely through to the choroid. By this undermining, all the trephine openings are connected together by a channel between the choroid and sclera. Following each undermining, Lindner injects, through each hole, 1/100 to 1/500 of a c.c. of 3-percent KOH solution into this space. He uses a very finely graduated syringe and a canula the end of which is quite flat, with the opening on the side so that it slides in as smoothly as a spatula. He inserts this canula until the end is about half way between the holes, and then makes the injection. This procedure causes a narrow, but absolutely continuous wall of choroiditis to be produced, which very effectively walls off an area of the retina. Furthermore, by undermining back toward the posterior pole of the eye, it is actually possible to reach the macula. To be sure of being just at the macula Lindner has his assistant observe with the ophthalmoscope to check his position, which he can then correct. After all injections are made and bleeding stopped, the choroid is perforated through several of the trephine openings, the conjunctiva and muscles sutured as usual, and the eye bandaged.

The advantages of this method are: fewer trephine holes to be made; possibility of reaching any part of the globe. The disadvantages, as pointed out by Lindner, are that all of the retina anterior to such an area of undermining is functionless, because the nerve fibers are destroyed where they pass over the injected area. In the original method, enough fibers between the trephined areas escaped to provide some function. However, Lindner believes that the advantages outweigh the loss of function in this unimportant part of the retina.

I will now take up another of the operations designed to wall off an area of the retina. This is Safar's[6] operation, which I personally have been doing recently. Safar uses the diathermy current to achieve an exudative choroiditis in place of the actual cautery of Gonin,

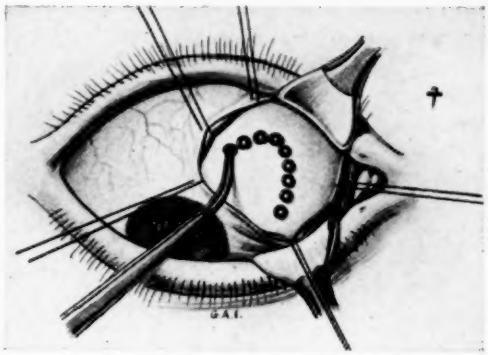

Fig. 1. (Pischel). Safar operation, 8 pins already in place, with pin held against sclera in forceps, just before applying current. Note insulated retractors, and silk sutures as retractors of conjunctiva Tenon's capsule, etc. On right side, view of one pin showing insulated guard in place against head of pin.

or the KOH stick of Lindner and Guist. But like Lindner and Guist he attempts to make a wall of exudative choroiditis which will act as a barrier to prevent the spread of the detachment. His technic is as follows:

He localizes carefully, about as Lindner does. The exposure of the field is similar to that of the Lindner-Guist operation. For this diathermy technic the field must be absolutely dry. Any moisture causes the current to jump away from the point of the needle, spreading over a large area. Then, instead of using trephines to open through to the choroid, Safar uses fine short needlelike pins about 4 millimeters long, thrust through small 2-millimeter discs which act as guards, leaving about 2 millimeters of the pin extending below the guard. He grasps one end of this needle, holds it in a forceps against the sclera, pressing on it with moderate pressure, and holds the active electrode of the diathermy current in contact with the forceps. With the diathermy current flowing through, he presses the pin through the sclera up to the disclike guard. This pin is then left in place, and a second one inserted. This goes on until all are in. Safar also has some "combs" which are really only 3 pins held in one rectangular guard, so that one can make 3 perforations at a time in the same

manner. These he uses in the same way as the individual pins. To reach far back to the posterior pole, a brushlike electrode with seven points, mounted on an insulated rod, can be used, which easily reaches anywhere around the eye.

Safar endeavors to draw a circle

Fig. 2 (Pischel). Side view of seven-point brush electrode, with diagram of position of pins in head of brush.

around an isolated hole, or to wall off whole areas, starting about 8 or 9 millimeters from the limbus, passing back toward the equator, around the affected area, and back to the limbus again, just as Lindner does. To reach far back behind the equator, he uses the brushlike electrode mentioned above. With this, even holes in the macula can easily be reached.

No pins are withdrawn until all are inserted. This is very important, for thus the subretinal fluid cannot escape and the retina is held away from the choroid out of danger. After all pins are in, they are withdrawn one by one. It is sometimes necessary to use a little current to loosen them. If they have gone through the sclera, subretinal fluid escapes through the minute openings.

The amount of current needed is between 75 and 125 milliamperes for 2 to 5 seconds. Only experience can show exactly how much current is necessary with any particular diathermy machine.

Special insulated retractors, such as ivory ones, are necessary to hold the tissues away. With these it is possible to reach surprisingly far back in inserting these pins. The pins are made short so that the eye, with the pins left in place, can be rotated about in reaching different areas.

The advantages of this operation include two most important ones. First, as the subretinal fluid is not allowed to escape until all coagulation with the diathermy current is finished, the retina is safely protected from trauma by being held away from contact with the pins as they are inserted. There is thus no possibility of tearing, burning, or cauterizing the retina itself, which might lead to new degenerating areas with new holes. This important feature can hardly be overemphasized. Secondly, as drainage takes place through many fine openings, the retina can settle back gently into its proper place without strain or traction. Furthermore, any part of the globe can be reached by the brush electrode. Besides these advantages, all those of the Lindner-Guist operation, such as treatment of one or several holes, or of a tear, or of sectors, hold good as well. Additional points are that the technic is not difficult, nor is it time consuming, as the placing of the individual pins is merely a matter of seconds.

The accidents and disadvantages of this operation are chiefly suppositions. Does the diathermy current injure the retinal elements or nerve fibers, or does it set up galvanic currents that would injure those tissues? According to Jess, of Giessen, if sufficiently high frequencies are used, there are no such dangers. It is necessary, however, to use current high and long enough to get a choroidal reaction. (I have found that the current should flow 1 or 2 seconds after the pin is entirely in place through the sclera.)

Of course one must be careful not to touch the lid or conjunctiva with the active electrode, as the burn, as well as the shock, is disagreeable to the patient. One may find that one or the other of the pin electrodes has not caused sufficient reaction, thus leaving an area without exudate. Only experience will prevent this, or the fundus can be inspected before withdrawing the pins, and any such areas can be subjected to a further amount of current.

Some think that the subretinal fluid will not drain out of these small holes quickly enough. To overcome this, a single large hole may be made with a large needle.

The final type of operation that I wish to take up is that of Larsson[8], who tries to create a very large area of diffuse choroiditis, which will cause large

parts of the retina to adhere to the choroid. Larsson does his work according to one of two plans. If he finds a hole, he endeavors to treat the quadrant involved. The same holds true if, from the history, one can be sure as to where the detachment started. If neither of the above holds true, he tries to operate upon the greater part of the whole detached area.

As in other operations, the conjunctiva and Tenon's capsule are dissected off and the sclera exposed and dried. Insulated retractors are necessary. Then with the patient well grounded to a large plate, Larsson takes for the active electrode a small bulb electrode about 2 millimeters large. With this and a current under 100 milliamperes, he touches the sclera. In order to avoid possible injury to ciliary body and lens, he does not come closer to the limbus than 9 millimeters. Contact is made for about 3 to 5 seconds, until the spot touched has a gray, parchmentlike appearance. Then another spot 3 millimeters away is touched, and so on until all the area to be treated has been covered. Then a single trephine opening is made in the most dependent portion of the treated area and the choroid perforated, draining out the subretinal fluid. No hemorrhage occurs as the choroidal vessels seem to be thrombosed. Bed rest with binocular bandage as in other operations is the rule.

What are the disadvantages with this operation? Technically, it is much the easiest to do. As drawbacks I see in Larsson's method the single large drainage hole which might pull the retina to it. Furthermore, with such extensive choroidal destruction some of the retina is also permanently destroyed, as can be seen by field defects in the healed cases. Several further questions seem important. Is it not possible that such extensive treatment of the sclera with diathermy current may lead to eventual weakness thereof, with subsequent formation of a staphyloma? May the extensive choroidal atrophy cause widespread secondary degeneration of the retina? Enough time has not elapsed to answer these questions.

Summary of the three types of operation, giving the advantages and disadvantages:

First type: Closing of hole or tear.

Gonin Operation

Advantages: Simple armamentarium; uncomplicated technic; short operation.

Disadvantages: Ultra-accurate localization; burning of retina; extensive scarring and secondary contracture with new holes; sudden egress of subretinal fluid through one large opening; cannot easily be used for multiple holes or large tears.

Second type: Walling-off operations.

Lindner-Guist Operation

Advantages: Localization easy; two or three holes in one area surrounded by a single circle of exudate; several holes in different parts treated at one operation; whole sector can be walled off; drainage going out through many openings allows retina to float back into proper place.

Disadvantages: Technic enormously difficult; very time consuming, taking an hour to an hour and one half (Guist himself may operate much faster, but he is an exception); difficult to reach far back towards the posterior pole; many perforations of choroid present possibilities of intraocular hemorrhage.

Safar Operation

Advantages: All those mentioned under previous heading of Lindner-Guist operation; retina kept away from choroid during all operative interference by unescaped subretinal fluid, thus being well protected from trauma; no possibility of intraocular hemorrhage as vessels are thrombosed; escape of subretinal fluid slowly through many fine openings so that retina can float back into proper place; no subsequent traction folds; possibility of easily reaching any part of the eyeball.

Disadvantages: Special armamentarium; slight difficulty in technic of inserting pins.

Third Type: Creation of extensive choroiditis.

Larsson Operation

Advantages: No localization beyond

rough estimate; ability to treat large detachments with no hole seen; easy technic.

Disadvantages: One trephine opening for drainage; extensive destruction of choroid and retina, extensive treatment of sclera; uncertain transscleral dosage.

Personal Experience: In the last eleven months I have had the opportunity of operating upon fifteen eyes with detachment of the retina. In four cases the eye was operated upon twice, making a total of nineteen operations. These were in fourteen patients, one patient having a detachment in each eye. Five were in the only eye.

The cases operated upon were not selected in any way, no patient being turned away, even if the outlook was practically hopeless. The prognosis in this operation varies with the type of case as in all other operations. Most favorable are the spontaneous detachments with a small single hole. Naturally, the greater the number of holes, the more unfavorable is the prognosis. Likewise, the length of time since the appearance of the detachment is important. Cases of three months' duration or less are very favorable, while with longer intervals the prognosis grows rapidly worse. Detachments in aphakic eyes are very unfavorable. Likewise, detachments in cases of old iridocyclitis with complicated cataract have a poor outlook. High myopia is, of course, a disadvantage. Cases which have already been operated upon by the method of Gonin are unfavorable. On the other hand, detachments following trauma, especially those with a tear at the ora, are supposed to be favorable.

Of the fifteen cases operated upon, five have resulted in cures. A sixth was cured and the original detachment remained cured, although a new detachment, directly opposite in location to the first, has appeared. Eight cases were failures.

Eight had an absolutely bad prognosis at the outset. Not merely somewhat unfavorable, as in a case in which no hole could be found, but very unfavorable, as follows: Two cases were in myopic aphakic eyes in which discissions had also been done. Two were cases in which a Gonin operation with galvanocautery had been unsuccessfully performed. One was a case of 18 months' standing, with six tremendous holes in different parts of the fundus. In one case the right had been destroyed by a charge of buckshot, and the left badly injured, with connective-tissue strands in vitreous and total detachment. Finally, two cases were of complicated cataract, with old iridocyclitis, massive vitreous opacities, and the other eye also blind from a detachment with similar findings.

Of these unfavorable cases, one, which had been unsuccessfully operated upon according to Gonin, was cured; the others were failures.

Seven cases had a favorable prognosis. Of these, three were of the large bullous type with a single hole, or two holes close together, in moderately myopic eyes (under minus 12). One was in a case of high (minus 20) myopia with a small hole; another of a moderate myopia (minus 1 with minus 5 cylinder) with a questionable tear. One was posttraumatic with a questionable tear. The final one was in a senile eye with incipient cataract and one tear.

Of these seven, four have resulted in cures, in a fifth a cure of the original detachment was obtained, with a new detachment appearing on the opposite side of the eye; another remained attached for a week, and has since not allowed further treatment; and the posttraumatic one with doubtful holes was a failure. This resulted in five absolute cures in seven favorable cases.

Thus six cures were obtained out of fifteen unselected cases. Very brief summaries of all the cases, in chronological order are appended.

Localization of the hole and of the area to be operated upon was as follows:

After the hole was found it was localized with the aid of a perimeter, in this way: The patient was directed to look straight at the fixation point of the perimeter. The hole in the retina was next located with the ophthalmoscope, and then the observer, keeping the

image of the hole always in the center of the pupil, backed away from the patient until the perimeter arm could be brought down just past his ophthalmoscope. When the arm was directly in the path of the beam of light from the ophthalmoscope it was stopped. Then the degree on the perimeter arm marked by the beam of light was noted as well as the axis to which the perimeter arm was turned. The latter would be the direction in which one would measure the distance from the limbus to the hole. The distance to be measured was then found by reference to Weve's table which convert the degrees found on the perimeter to millimeters to be measured from the limbus.

TABLE FOR CONVERTING DEGREES INTO MILLIMETERS (AFTER WEVE)

Angle in degrees between visual axis and ophthalmoscope, (as obtained from the perimeter or tangent screen).	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20
Distance to be measured in straight line from the limbus (corneal diameter of 12 mm.).	7	8	8¾	9¾	11	11¾	13	14	15	16	17	18	19	20	21

I have performed the Safar operation, following his technic with only occasional variations. In some of the early operations, I used the bulb electrode in addition to the Safar pins, to treat additional areas. This I have largely given up. I usually make one larger opening with a single big needle at the close of the operation.

All operations were done under local anesthesia, with instillation of cocaine and with retrobulbar injection of novocaine. Usually subconjunctival injections were unnecessary. The original pins, combs, and brush electrodes of Safar were used, except in a few cases where the pins developed by C. B. Walker were used. Both eyes were bandaged for eight to ten days, after which stenopeic spectacles were worn for about three months.

Conclusions: The Safar operation seems to be the best one for treating detachment of the retina, because of the following advantages: Ultra-accurate localization is not necessary; several holes or large areas can be treated in one operation; drainage goes out through many small openings; the retina is kept away from choroid during the whole of operation so that it is protected from trauma; there is no possibility of intraocular hemorrhage; any part of eyeball can be reached; the technic is fairly simple; it is not time consuming.

Case reports

Case 1

Twenty-five-year-old student had been operated upon in both eyes for congenital cataract. A discission in the right eye was followed in one month by detachment, far temporally and above, where typical hole was seen. August 10, 1932, this area walled off by a semicircle of 12 pins. Retina reattached. Six months later relapse, and reoperated, making larger semicircle of 18 pins. Remained attached for 3½ months, and upon discarding stenopeic spectacles, third relapse. Failure.

Case 2

Seventy-one-year-old laborer, highly myopic, operated upon for senile cataract, followed by discission. Eighteen months later total detachment. Hole seen 2D.D. nasal from disc. October 1, 1932, Operation. Six-point brush electrode passed nasally behind eye, and applied to globe at two points. Subsequently could see hole had been missed. Reoperated and with brush electrode treated area of hole, but retina did not return to place. Failure.

Case 3

Twenty-nine-year-old baker, struck over highly myopic only eye with bad vision due to central chorioiditis. Vision immediately began to fail. Detachment found and hole located below and operated on by Gonin method. Cured for 5 months. Relapse. New hole (?) seen temporally below. October 25, 1932, suspicious area walled off by semicircle of 14 pins. This area remained attached but nasal area detached again. A questionable hole on nasal side, below found, and this area walled off with 12 pins on May 18, 1933. Retina returned to place and field improved. Vision 0.1 Field practically normal. Cure. Elapsed time between operation and last examination on October 19, 1933, 5 months.

Case 4

Fifty-five-year-old baker. Several months ago vision of left eye failed. Total detachment with 6 large holes scattered about fundus found at "2, 3, 4, 7 and 7½ o'clock." November 20, 1932, Temporal holes walled off by long line of pins from lateral border of superior rectus to inferior rectus. Holes at "7 and 7½ o'clock" treated with bulb electrode. Retina did not go back into place. Failure.

Case 5

Forty-year-old housewife. Vision of right eye failing two weeks. Almost total detachment in eye with maculae of cornea, complicated cataract, and many vitreous opacities. Tear at ora in horizontal meridian, nasally. December 1, 1932, the tear walled off by semicircle of 18 pins. No improvement. Operation repeated without success. Retina did not change position. Failure.

Case 6

Fifty-three-year-old housewife. Vision in only eye (L.E.) blurred for 3 weeks. Had frequent eye inflammations. An almost total detachment with questionable areas nasally and temporally below seen with great difficulty, due to vitreous opacities. December 15, 1932, these two areas walled off by long semicircle of 21 pins. No change in position of retina. Failure.

Case 7

Sixty-five-year-old housewife. Several months previously, vision of right eye failed and large detachment of retina, with tear directly above, found. Operated upon according to Gonin, but hole missed. Now hole and operative scar easily seen. December 19, 1932, the six-point brush applied to the area peripheral to old scar. Inspection of fundus showed only half of hole covered, so brush applied twice more, and all of hole area coagulated. Retina went back into place and remained so. Vision 0.7. Field normal. Cure. Elapsed time between operation and last examination on June 23, 1933, 7 months.

Case 8

Sixty-eight-year-old housewife. Three weeks ago vision of left eye blurred. A large detachment over upper half of fundus seen, with hole nasal and above. February 1, 1933, this area surrounded by horse-shoe of pins, and another semicircle of pins placed around temporal detached area. Retina returned to place. Subsequently, patient developed severe bronchitis and a vitreous hemorrhage developed. Later a new detachment appeared far below. Failure.

Case 9

Sixty-four-year-old clergyman with chronic bronchitis. Seven days previously flashes of light before right eye, followed in two days by blurring of vision. A large bullous detachment in a myopic eye, with tear seen temporally and above. February 10, 1933, the tear surrounded by semicircle of pins. The retina promptly returned into place, and has remained so. Vision 0.6. Field normal. Cure. Elapsed time between operation and last examination on October 21, 1933, 8 months.

Case 10

Twenty-five-year-old mechanic. Shot in face with birdshot 18 months ago, one eye lost. Other eye (L.E.) badly contused. Retained some vision but this now failing. A total detachment, with connective tissue in vitreous, and many opacities seen. Suspicious area far temporally above, is all that could be found. March 30, 1933, this area walled off with 12 pins in semicircle, but no good result obtained. Failure.

Case 11

Fifty-five-year-old cook (see case 4). Right eye vision poor for several weeks. Flat detachment in lower half seen with one suspected hole temporally and below. April 4, 1933, this hole walled off with semicircle of 18 pins, and surrounding area touched with bulb electrode. Retina returned into place, field became normal, vision returned to former state (0.3). Cure. Elapsed time between operation and last examination on September 29, 1933, 5½ months.

Case 12

Fifty-nine-year-old engineer. Five days previously vision in only eye (R.E.) blurred. A large bullous detachment with two holes seen temporally and superiorly. May 6, 1933, these two holes surrounded by semicircle of 16 pins, and the six-point brush applied over each hole. Retina reattached, vision improved, and field became normal. Vision 0.7. Cure. Elapsed time between operation and last examination on October 20, 1933, 5½ months.

Case 13

Forty-one-year-old laborer. Right eye always very shortsighted. 1½ years ago, vision became very blurred. An almost total detachment, except nasal above, seen in a highly myopic eye. A small round hole found inferiorly in midline. May 18, 1933, this hole

walled off by semicircle of 15 pins, and surrounding area treated with bulb electrode. Retina promptly reattached, Field normal. Vision 0.1. Cure. Elapsed time between operation and last examination on October 15, 1933, 5 months.

Case 14

Forty-one-year-old mechanic. Was struck over right eye 3 years ago. Past 8 days vision very poor. A rather flat detachment practically total found. Temporal below, a suspicious area, and another far nasally. May 20, 1933, the area temporal below surrounded by circle of 5 pins. Then semicircle of 22 pins in a double row put around area far nasally. Wound became infected, and after most stormy convalescence with corneal ulcer, iritis, etc., eye was saved, but with no vision. Failure.

Case 15

Sixty-eight-year-old housewife. Two weeks ago noted blur before left eye. Large bullous detachment seen in temporal half of eye, with tear far temporally and below. May 25, 1933, this area surrounded by small semicircle of 9 pins. Retina reattached but in 6 days detached again. Failure.

490 Post Street.

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NOTES, CASES, INSTRUMENTS

OPTOCHIN AMBLYOPIA

B. W. Pasternacki, M.D.
DETROIT

On April 7, 1932, I was called to see a patient, a woman 32 years of age, who complained of partial blindness. Two weeks previously she had developed pneumonia and had been given twelve 2-grain tablets of optochin the day of onset. The next day, March 25, the same dosage of optochin was repeated. On the following day head-noises and poor hearing developed and within 60 hours after the first dose of optochin the patient was completely blind.

At examination the pupils were widely dilated, reacting feebly to strong light. The tension measured 32 mm. in each eye (McLean). The retinæ were of a yellow straw-like color, the veins were hardly visible, the arteries were pale and the discs white. The condition no doubt was due to the optochin accompanied by retinitis septica and bilateral retrobulbar neuritis.

Twenty-one days after the onset of the illness she was delivered of a premature eight month baby and eight days later an operation for empyema was performed. Three pints of purulent fluid were drained from the pleural cavity after rib-resection. A week later a large rectal abscess was opened.

At this time the laboratory findings were as follows: sputum positive for pneumococcus; urine, albumen two plus, no sugar; white blood cells 21,800; lymphocytes 2 percent, large mononuclear cells 8 percent, neutrophilic cells 90 percent. The Wassermann was negative and blood pressure normal.

During the first week following April 7, eserine was used in each eye. Antipneumococcus serum was administered daily. From June 1 strychnine sulphate gr. 1/60 was injected in the temporal region changing sides on alternate days. These injections were reduced to two a week after June 20.

On August 26, she visited my office and could recognize and describe white metal furniture. Treatments of faradic current from three dry cells were applied for three minutes to the forehead and around the eyes, especially to the supraorbital nerve. Also potassium iodide was given internally.

She left the city on September 25, at which time her vision was 5/35 in the right eye and 5/20 in the left eye. The near vision was Jaeger 10 at 34 cm. The visual fields were contracted and there were large paracentral scotomata. The retinal vessels appeared wider than at first, and the discs less white. On March 24, 1933, one year after the illness, the vision was 5/15 in each eye.

5765 Chene Street.

ATROPINE SOLUTION GIVEN BY MISTAKE ON PRESCRIPTION FOR PILOCARPINE

Thomas D. Allen, M.D.
CHICAGO

Mrs. I. A., 44 years old, was first seen February 6, 1933, having an advanced case of noncongestive glaucoma in each eye. The pupils were 3.5 and 5 mm. in diameter, the anterior chambers slightly shallow, the corneae normal, and there was well-defined glaucomatous cupping 4 D. deep, with atrophy, pulsation of retinal arteries, and distinct glaucomatous halo. Tension was O.D. 60, O.S. 62 mm., Schiötz—new scale. There were only a small central field and a temporal island of vision in each eye. Eserine, pilocarpine and suprarenin bitartrate were used in succession and in various combinations for two weeks before the tension fell to 30 or below. After another two weeks because the tension rose to 48 mm. in the right eye, an iridencleisis was done, successfully.

The patient was sent home with a small left pupil and a prescription for 1-percent pilocarpine for that eye. Three days later the daughter telephoned that the patient was very dizzy and nauseated and she was brought back to the hospital. Here her left pupil was found widely dilated, tension +3, vision hand

movements. She was quite nervous, her mouth was dry, and she was having several loose bowel movements per day.

Vigorous treatment with eserine and pilocarpine, heat, and rest in bed was instituted with the result that in a few days tension was so reduced that an iridencleisis was done on this eye also with, fortunately, an excellent result. The bottle of medicine obtained on the prescription was examined physiologically and found to contain a pupil dilator—two other patients being used. There was only a minute portion of a drop in the bottle so two drops of physiologic salt solution were added, and these were used in one eye of each of two patients. Within a half hour the pupils of each were widely dilated and remained so for several days.

The prescription was traced to the drugstore, found to be correctly written and a sample of pilocarpine obtained from the bottle of stock solution which the druggist claimed to be the bottle he used in filling the prescription; also a fresh 1-percent pilocarpine solution was made up by the druggist for verification physiologically. Both of these solutions caused prompt miosis, the one from the old solution in the other eye of one of the patients whose one pupil had been dilated by the previous solution.

We are, therefore, forced to the conviction that a mistake was made by the druggist in filling the prescription. This druggist is a most careful man. He has successfully filled the same post in a large prescription store for many years, and this is the only time he has been known to make a mistake.

Moral: It is human to err, but it is sometimes costly.

122 South Michigan Avenue.

SOCIETY PROCEEDINGS

Edited by Dr. H. Rommel Hildreth

OPHTHALMOLOGICAL SOCIETY OF THE UNITED KINGDOM

Annual Congress, London

May 11, 12, 13, 1933

Dr. A. H. H. Sinclair, president

The value and technic of the use of radon in certain intraocular conditions

Mr. R. Foster Moore read a paper on this subject which dealt with the type of case of intraocular disease which seemed to be amenable to treatment of radium emanations in the form of seeds, and with the technic and the results of the treatment. The results, he said, were only tentative.

The types of cases considered were: sarcomata, gliomata and angiomata. The first case was that of a man of 65 years, who had sarcoma of the choroid in the left eye, the right having been practically blind since childhood from leukoma adherens. As he would not have the only eye removed, he was treated with radium, and at the end of three and one-half years the growth was less than before the commencement of treatment, there was no extraocular extension, nor discoverable evidence of dissemination. This showed that one could insert radon seeds into such growths when they were at all accessible, and sloughing of the sclerotic or other tissue need not be feared; therefore efforts were made to stabilize or improve the technic.

Another case of sarcoma was that of a man aged 39 years, who had a tumor in the left eye and had had a traumatic cataract of the right eye since he was a child and who refused to have what he regarded as his "good eye" removed. A radon seed was inserted interstitially, and later a scleral application of two seeds outside the growth. Treatment of the traumatic cataract of his other eye was done at the same time, and eventual vision was 6/9. Then he agreed to have the eye, with the growth in it, removed.

Mr. Foster Moore said that five cases of retinal glioma had been treated, some by interstitial insertion, some by a combination of the two methods. A striking case was that of a boy whose elder brother died of double retinal glioma, therefore the mother declined the suggestion to have both the eyes of this boy removed. Mr. Moore used radon seed for it, and now three-and-a-half years later the boy was in good health and attended an ordinary school. The original site of the growth was now flat.

With regard to retinal angiomata, one case was that of a woman aged 24 years, one eye of whom was blind from extensive angioma: in the other eye was a small angioma, which was increasing in size. She was treated by the scleral application of three seeds, each of 5 millicuries strength, which were left in position ten days. An area of the retina, including the angioma, and for some distance around, quickly developed the appearance usually seen in coagulation necrosis, with a few hemorrhages on the surface. This appearance slowly subsided, giving place to a mottled appearance, the vessels became obliterated, and there were no signs of the angioma. Central vision remained at 6/6, but a defect in the visual field was present coterminous with the scarred area. Now 11 months later nothing could be seen of the growth. This patient had now developed a few small whitish areas in the macula. The significance of these was not clear.

With regard to the choice of cases for the treatment, it was not recommended by the reader for melanotic sarcoma if the other eye was sound, and in the case of an early growth, application was made only if enucleation was refused, but if a sarcoma could be effectively irradiated, the danger of dissemination ceased from that moment. Radon treatment was not recom-

mended by the reader as a substitute for enucleation in an uniocular case: but there should be a very careful examination of the second eye under a general anesthetic, as it was possible to overlook a small growth.

The case was different with binocular glioma, for here a really early stage of the growth was encountered. In retinal angiomata radon was very successful and was the only effective treatment at present. The condition was rare. In Eales' disease, no known treatment had any influence on its course, of which detachment of the retina was the commonest sequel.

As to technic, the weakest strength used was 1 millicurie, the strongest 5.3 millicuries, interstitially inserted: the greatest dose by this means was five 3.5 millicurie seeds. All had been filtered through .5 mm. of platinum. The seeds were usually left in for ten days, but sometimes for a shorter time. Interstitial insertion seemed to be the proper method in growths which protruded into the vitreous, but if the tissue to be irradiated lay flat against the outer coats of the eye, for such an angioma or vessels in Eales' disease, scleral applications seemed less risky. The two methods might be combined.

Before using the needle, the ventral surface was painted with an alcoholic solution of gentian violet, then allowed to dry. If the growth was small he had used a rubber collar on the posterior end of the seed to prevent it falling loose inside the eye.

The chief complications to look out for were; suppuration and the effect of emanations on the surrounding tissues. Changes in the lens had occurred in two cases, and in two patients there was panophthalmitis. Scarring of the choroid and retina could be affected by this treatment so as to obliterate blood vessels, and so prevent the disease leading to blindness.

The etiology of glaucoma

Mr. W. S. Duke-Elder said the picture of acute glaucoma was one resulting from a vascular crisis in the eye. The most dramatic crisis which could be produced was accomplished by causing a total cessation of the circulation and then allowing it to start again, carefully observing what happened. This was done by raising the intraocular pressure to a height above that of the ophthalmic artery (by an apparatus which was demonstrated). Within 30 seconds after the circulation had been allowed to resume, the vessels in the iris were observed to be maximally dilated, the amplitude of the pulse recorded in the tracing became greater, and (after it had been injected intravenously) the appearance of trypan blue over the surface of the iris evidenced a marked increase in the permeability of the capillaries, which, after a considerable occlusion, was so pronounced that the dye penetrated into the glass chamber of the optical manometer. A rise of temperature to the extent of 1 degree to 2 degrees showed an increased blood flow, the pupil constricted maximally, and after one to three minutes, the intraocular pressure rose sharply. Later, though the increased pressure was maintained, the amplitude of the pulse declined. These events, especially the maintained maximal dilatation of the small vessels and constriction of the pupil, seemed to indicate that the cause of the disturbance was the liberation of a histamine-like substance in the eye. The injection intravenously into cats of the aqueous humor withdrawn from such an eye showed that such a vaso-dilator substance was present. These results showed a close association with the activity of the histamine-like substance which Sir Thomas Lewis and his colleagues demonstrated to have widespread effects on the skin. By stroking the skin Sir Thomas had produced a triple response. A series of experiments was therefore carried out in which the essential feature was to stroke a segment of the iris with the cannula of the manometer as it lay in the anterior chamber. In the normal animal the capillaries of the eye were impermeable to trypan blue. A dilatation of the small vessels was noted after a latent period of 30 seconds, extending markedly over the area of the iris which had been stroked. Secondly, increased permea-

bility of the minute vessels on the surface of the iris was denoted by the appearance of the violet color of trypan blue, at first over the whole iris surface. Thirdly, after a latent period of 60 seconds, there was a rise of temperature of .5° C to 1.5° C. This then gradually fell. Fourthly, a maximal and constant constriction of the pupil was seen 30 seconds after stroking, and it persisted indefinitely. There was also a rise in the intraocular pressure, starting after a latent period of two or three minutes.

After 2 percent cocaine solution had been instilled into the conjunctival sac, in drops at two-minute intervals, the stroking produced only a very modified response. Apparently there were two types of response: one of local distribution and independent of nervous activity; the other of which was general in distribution and took place only when the sensory nerves were allowed to function. The suggestion was thus inevitable that here was an axon reflex mediated by the trigeminal, similar to that described by Bruce in 1910, as occurring in the conjunctiva.

Spasm of retinal artery

Dr. H. M. Traquair said that spasmodic closure of a branch of the retinal artery, or of the whole artery could occur at various ages. Some were in middle-aged or elderly people who had retinal arterial disease associated with either arteriosclerosis or syphilis; but others were in young people, some of whom presented spasm in other parts, especially the fingers. There was recurrent loss of vision, in some affecting one eye only, in others each eye alternately, or both might be affected together. After several attacks there was frequently a permanent visual defect. Examination showed that the permanent defect corresponded to the distribution of a branch of the retinal artery. Before this stage, the fundi and fields were found to be normal between attacks. Cases not associated (as in older subjects) with arteriosclerosis, seemed to be allied to the neurovascular disturbances of which migraine was a type; they were not characterised by any abnormal vascular condition between the manifestations. The scotoma might be due to ischemia of the whole area, including the nerve fibers and the cells of the inner layers of the retina supplied by the obstructed branch, or to ischemia of a bundle of nerve fibers alone. When a case of retinal arterial obstruction had been treated by massage or nitrites with resulting relief, it should not be too readily assumed that an embolus had been displaced, or that the restoration of the circulation had been due to the measures employed.

(Reported by H. Dickinson)

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

January 17, 1933

Dr. Hugo B. C. Riemer presiding

Vernal conjunctivitis

Dr. Allen Greenwood showed a young man who had come to him in October, 1931, complaining of heaviness of eyelids and difficulty in keeping his eyes open. There were enormous conjunctival cauliflower-like excrescences at that time. He was given a solution of adrenalin to instill in each eye, and the following morning he could open his eyes with less difficulty. He had been taking large doses of cod liver oil, had gained thirty pounds in weight, and the eyes were symptom free.

Result of operation in case of buphthalmos

Dr. Frederick H. Verhoeff showed a 12-year-old girl who had been referred to him at the age of six months with the diagnosis of buphthalmos, both eyes. A trephining was performed and she continued to do well for a long time. Last summer she was referred to Dr. Verhoeff again. The right eye had gone blind due to a separated retina. The tension of the left eye was between 30 mm. and 40 mm. (Souter). A subconjunctival incision was made, such as was made for the Reese iridectomy, but the iridectomy was omitted. A smooth bleb resulted which had persisted for four months, and which Dr. Verhoeff

felt would remain indefinitely. After the operation the tension was 12 mm. (Souter). Dr. Verhoeff said he often performed this operation in many cases of secondary glaucoma.

New tests for stereoscopic vision

Dr. Frederick H. Verhoeff demonstrated an improved old, and new test for stereoscopic vision. This test was published in the American Journal of Ophthalmology (1933, v. 16, July, p. 589).

Unexplained exophthalmos

Dr. Hugh C. Donahue showed an eight-year-old boy who came to the hospital four years ago complaining of slight pain below the left eye. There was one degree of left hyperphoria; otherwise the eye examination was normal. X-ray showed pus in both antra, and a left radical antrum operation was performed. The patient now returned complaining of pain in the left eye, gradually increasing in severity, with 6 mm. of exophthalmos in the left eye and 14 degrees of hyperphoria in the left eye. Muscular excursions were normal. The vision was 20/20 in the right eye, and 20/40 in the left. The fundi were normal. Clinical examination by the pediatrician was negative. No pulsation was felt, nor any bruit heard, over the orbit. X-ray of skull and sella turcica was normal. The left orbit was definitely larger than the right and there was a uniform thinning of the bone through the orbital structure. Upon deep palpation over the lower orbital margin a soft and freely moveable mass was felt just beneath the eyeball. In consideration of the x-ray findings and the palpable mass, it was believed that this was a slowly growing lesion exerting pressure within the orbit causing the eye to be pushed forward and upward. It was also believed that it might be a cyst connected with the left antrum; a lymphangioma, hemangioma, or plexiform neuroma.

Result of Guist operation

Dr. James J. Regan presented two cases of separation of the retina showing the result of operation by the Guist technic. In the first, a woman of 32 years, the separation occurred spontaneously five months before the operation, which was done four months ago. In the second case, a man of 25 years, the separation occurred spontaneously one week before the operation which was done six months ago. There was return of normal field, vision improved from 20/200 or less to 20/70, and there was very little reaction, especially in the vitreous, in either case.

Duane's syndrome

Dr. Trygve Gundersen showed a seven-year-old girl who had had an occasional squint in one eye since birth. Her general health was excellent. Examination showed bilateral fixation in forward gaze. There was complete absence of abduction of the right eye, and only ten degrees adduction combined with about ten degrees of hypotropia. On adduction of the left eye there was a retraction into the orbit of the globe of about 3-4 mm. This caused narrowing of the palpebral fissure and an actual ectropion of the lower lid. There was also about ten degrees of hypotropia which developed on adduction; possibly an overaction of the superior oblique. The Hinton test was negative. Visual fields were normal. X-rays of skull and sinuses were negative. Vision with glasses was 20/50 in both eyes. All the points which Duane emphasized in his summary of 54 cases in 1905 were present in this case.

Dr. James J. Regan
Recorder.

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EDITORIAL STAFF

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WILLIAM H. CRISP, consulting editor
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EDWARD JACKSON, consulting editor
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OUR EUROPEAN GUESTS

The intelligent physician is constantly striving to increase his knowledge of his chosen subject. Personal experience is the best and most convincing teacher but its field is limited and it is not always easy to interpret correctly the lessons that might be learned. The physician recognizing this has recourse to text books, journals and monographs and from these adds a considerable amount to his storehouse of knowledge. It is, however, difficult to visualize and evaluate information so acquired. The meaning is not always clear and the questions that arise in the reader's mind remain unanswered so that often the subject is dropped while yet undigested and the value of the text remains unabsorbed. A most convincing way to delve to the bottom of a subject is by the laboratory method but so very rarely is this possible that it scarcely merits mention. Perhaps the most delightful manner of acquiring knowledge is to study under a great teacher and learn from the spoken word and the demonstrated case.

For many years American ophthalmologists have made the long trip to Europe for the privilege of listening to the heads of renowned clinics. In spite of the time and money consumed, one never hears a returning physician say that he has not been well repaid. But to few is this chance open. A slight compensation has been that occasionally such world-famous figures as Ernst Fuchs have come to the United States and given courses never to be forgotten by those fortunate enough to have sat at the feet of the master. Not only are they important for the knowledge acquired but for the opportunity afforded for intimate contact with truly great men. Recognizing the value of such demonstrations our own Dr. Jackson has, as we all know, given a course in optics to enthusiastic listeners in many of our cities.

This winter the United States is particularly fortunate in the possibility of having two renowned ophthalmologists as visitors, Professors Elschnig and Bielschowsky. As the master of ceremonies would say "They need no in-

troduction." Their clinics in Prague and Breslau have been Meccas for students for many years but as far as the editor is aware neither of them has ever given courses in this country. Outstanding for so many accomplishments, it would be difficult to select those for which each of these men is best known.

Professor Elschnig will be the guest of the Los Angeles Ophthalmological Society for two weeks during January and will then give courses of five days each in New Orleans, Saint Louis, Kansas City and Chicago; possibly in other cities also, though the editor has no further information about this. Elschnig will discuss syphilis and the eye, cataract extraction, medical and surgical treatment of glaucoma, plastic lid operations, blood diseases in relation to the eye, and many other subjects, as well as giving operative demonstrations. It is needless to expatiate on the treat in store for those fortunate enough to hear this famous ophthalmologist.

Professor Bielschowsky's coming is less certain but it is planned for him to be the guest of ophthalmologists of New York City, and later to give his course in other cities of this country. He has spent years in the study of the ocular muscles and has written extensively on this subject, among many other contributions to ophthalmology, and it is on this theme that he will give his demonstrations.

Whether it is still possible for these professors to add other cities to the list of those in which they will lecture the editor does not know but he wishes to call to the attention of our ophhalmologists the chance to honor these distinguished guests and in behalf of the American Journal of Ophthalmology he wishes to welcome them to our country.

Lawrence T. Post.

THE AMERICAN BOARD FOR OPHTHALMOLOGY

In 1915 the American Ophthalmological Society, the Section on Ophthalmology of the American Medical Association and the American Academy of Ophthalmology and Oto-Laryngology, adopted the reports of their collaborating committees and established a board "to arrange, control and supervise examinations, to test the preparation of those who design to enter on the special, or exclusive practice of ophthalmology." The subject of education for special practice in this branch had been considered for several years, in the papers and discussions of their annual meetings.

How well the profession was represented in this advanced step may be judged by the names signed to the report urging such action, now that half of them have completed their professional careers. They were: George E. de Schweinitz, Myles Standish, Samuel D. Risley, John E. Weeks, William H. Wilder, Hiram Woods, Walter R. Parker, Alexander Duane, William Zentmayer, Wendell Reber, Walter B. Lancaster, Edward Jackson. Nearly all of these subsequently served on the examining Boards. This fundamental step in professional organization was taken after careful consideration and with proper respect for traditions and time honored customs. At the Milwaukee meeting last June of the American Medical Association, five sections were found interested in the management, or establishment of such boards, for the examination of young physicians entering various branches of special practice.

The first examination for ophthalmology was held at Memphis, Tennessee, December, 1916. Up to the present time 41 such examinations have been held in large cities of the country. At the last one, held in Boston, September 18, there were 52 candidates who presented themselves for the examination. The certificate of the Board has been awarded to more than one thousand American ophthalmologists; and to seventeen who reside in Canada, Cuba, Hawaii and Mexico.

Its examinations have always been practical. They began with the professional record of the applicant, his preliminary and medical education, his previous practice, his studies in ophthalmology; his experience in practice, in clinic, as office assistant, or private practice; his published writings, or part

in discussions of medical societies were considered; and his ethical fitness for a liberal profession. In the earlier years many were certified upon their records alone. But from the first a close personal examination was conducted, to allow younger men to prove their competence. These included case reports, written, oral, laboratory and clinical examinations, held at some of the largest eye clinics and general hospitals of the country, to include the actual examination and description, of patients and pathological specimens.

The practical examination is usually divided into eight parts, each conducted by an examiner, and usually one especially interested in that subject. These are: 1. External diseases of the eye, including pupil reactions and tension of eyeball. 2. Ophthalmoscopy. 3. Laboratory examination on Anatomy and Pathology. 4. Errors of refraction, practical testing of patients. 5. Tests and disorders of ocular movements. 6. Perimetry and fields of vision. 7. Relations of ocular conditions to diseases of other parts of the body. 8. Therapeutics and operations.

Of the 41 examinations that have been held, 34 have been in the eastern and seven in the Pacific Coast and Rocky Mountain States. Next year the American Board for Ophthalmology, as it is now called, has agreed to hold an examination in connection with the meeting of the Pacific Coast Oto-Ophthalmological Society, if enough applicants desire to take the examination at that time. The American Board for Oto-Laryngology will hold its examination at the same time and place, if enough applicants desire its examination.

These examinations entail on the examiners a considerable expenditure of time, as well as traveling expenses. It is reasonable for those who wish to take them to show that they are needed. Ophthalmologists in the western part of the United States, who wish to get the certificate of the Board of Ophthalmology should at once secure the needed information from the Secretary, Dr. W. H. Wilder, of Chicago; file their applications and do whatever else is necessary, such as preparing required case reports, and schedule of studies pursued in preparation for the practice of ophthalmology.

The certificate gives no academic title but it is a requirement for membership in the national and many local societies devoted to ophthalmology. It is also of positive value in seeking hospital, or corporation appointments, for ophthalmic service. Those who possess it will be looked to as well prepared specialists, by doctors who are asked about whom to consult in other parts of the country. The number of such boards is rapidly increasing and their work has an important influence in developing the ideas of the profession and the public, on what may properly be expected of the specialist. Edward Jackson.

THE OPTICAL CODE

An attempt is being made by certain individuals under the NRA to abuse the code privilege by the wording of codes in such a manner that the code of one industry will affect competitors engaged in a profession not limited by any code. This may be specifically said of the technical arts allied to the professions of medicine and dentistry. In one instance the dental technicians have sought to limit the technical work to be done by the practising dentist. We are particularly interested in the administration of any code affecting the optical industry. A copy of the last draft of the code for the optical retail industry in California has numerous clauses which would affect many practising ophthalmologists.

In this draft the optical retail industry is defined as embracing all persons distributing eye-glasses or their accessories to the ultimate consumer. This also involves partnerships, associations, trusts and corporations engaged in this industry. After other provisions concerning hours, wages, and child labor, it is stated that the code authority is to consist of twelve members; four from the Guild of Prescription Opticians, four from the American Optometric Association, and four from the Better Vision Institute. It is thus seen that the administration of the code is entirely in

the hands of optometrists and lay opticians, although its regulations would affect eye physicians.

In the first place, those eye physicians who because of necessity or convenience deliver eye-glasses to the ultimate consumer, would come under this definition of the optical retail industry, and therefore under the provisions of this code. Secondly, in a broad sense eye physicians who employ an optician to dispense their eye-glasses, would also be subject to regulation by the code.

Apparently the President had no intention of subjecting medical men actively engaged in the practice of their profession to the restrictions of a code, for the practice of medicine is such an individual matter that each physician must be allowed to work out personal problems with his own patients. It therefore behooves ophthalmologists in different parts of the country, as well as medical men in other lines, to see that codes are not enacted by industries technically related to their practice, which curb or regulate their activities in any way. If it is necessary for eye physicians or any other physicians to have a code, it should be one of their own devising and one which is controlled by members of their own group. Because under certain conditions a physician dispenses drugs to a patient, that does not necessarily make him a druggist; and because glasses are dispensed by practising ophthalmologists where the occasion arises, should not be considered sufficient reason to class them as part of the optical retail industry, and subject them to legal regulations imposed by persons not so highly trained in a specialty as themselves.

The purposes of the NRA will be defeated if selfish individuals are allowed the use of a code of fair competition as a means of advancing their own interests to the disregard and attempt at control of a profession which has heretofore been more than fair to everybody but itself. We must object to the principle of alien control of any of the practices of medical men actively engaged in their profession.

M. F. Weymann.

OBJECTIONS TO IRIDENCLEISIS

The recent surgery of simple glaucoma is an excellent illustration of the extent to which any one of several operations for a given purpose may be practiced to the exclusion of others in a given locality, rather by force of habit and environment than because the operation thus favored is necessarily superior to the others.

In France and in some other European countries, as well as in Latin America, the Lagrange is much more frequently employed than any other of the filtration operations. This is chiefly due to the fact that in France Lagrange was the pioneer of the fistulizing treatment for glaucoma.

In England and the United States especially, Elliot's trephining operation is deservedly popular, and the author of that operation, although not the first to suggest some such procedure, is to be ranked with Lagrange as a pioneer in this most fruitful field of surgical progress.

It may be that as great a distinction will ultimately be associated with the names of Holth and Borthen, the originators of iridotasis or iridencleisis, for this operation has yielded statistics no less and perhaps more favorable than those of Lagrange's sclerectomy and Elliot's trephining, and is perhaps even more logically derived from a correct understanding of the principles upon which surgical filtration is obtainable.

It has often been said, and with much show of truth, that for any given purpose a surgeon should continue to use the type of operation which he can use with confidence, instead of alternating between different methods. It may even happen that the surgeon is temperamentally better suited by one form of operation than by another which serves the same purpose.

Lagrange's sclerectomy and Elliot's trephining both start from the idea that it is desirable to create a fistulous opening by cutting a hole in the sclera. Unfortunately such scleral openings tend to become occluded by dense scar tissue, and Holt is probably correct in concluding that the only successful filtration operations are those in which iris

pigment remains incarcerated between the lips of the scleral wound.

Iridencleisis starts from the assumption that the one thing necessary is to insure such incarceration of iris pigment, and this operation consists essentially of bringing out a tag of iris tissue which is left lying under a broad conjunctival flap, without any attempt at removal of scleral tissue.

When such a procedure was first advocated it seemed to run counter to surgical experience, since permanent exposure of iris tissue outside the ocular cavity had been found productive of chronic and dangerous irritation. But the kind of iris prolapse produced in the operation of Holth or Borthen is very different from the ordinary traumatic iris prolapse, in that the former protects the iris with a thick layer of conjunctiva.

It is a matter of experience that eyes in which iridencleisis has been performed with due care as to the conjunctival flap are singularly free from postoperative reaction or any chronic irritation which could be attributed to the presence of iris tissue outside the sclera.

Several writers of renown seem to have condemned iridencleisis without adequate personal experience in its performance or as to its results. Thus, Wilmer, speaking a year or two ago at the Oxford Congress, stated that he had shrunk from performing the iridencleisis operation "because of the possibility of sympathetic ophthalmia and the danger of detached retina occurring many years later;" and Peter remarks that the surgical principle involved is basically contrary to the teaching of a century.

Yet, in actual fact, a larger percentage of cases of postoperative inflammation have been recorded after either the Lagrange or the Elliot type of sclerectomy than after iridencleisis, and late postoperative infection has been regarded as one of the important dangers of the two former operations. Moreover, the sclerectomy operations carry greater risk of sudden deterioration from excessive reduction in tension than does the iridencleisis operation.

Wright has objected to iridencleisis on the ground that it is unsatisfactory for patients who must be sent away into the country beyond the possibility of close observation. It is true that the immediate reduction in tension from iridencleisis is often imperfect, and that the patient frequently needs pilocarpin once or twice daily for a fairly prolonged period. But such eyes usually respond readily to the use of pilocarpin, and Holth and other Norwegian workers prescribe for all country patients the instillation of pilocarpin, two per cent solution, once or twice daily for six months, beginning two weeks after operation.

Iridencleisis is a simple operation, and with reasonable care may safely be performed by any one of good surgical training and experience even though he has never witnessed its performance by others. Arnold Knapp has recently pointed out, on the other hand, that "trephining is not so simple a procedure as it is made out to be;" and it is much easier to be sure of an adequate conjunctival covering in iridencleisis than in trephining.

To many experienced ophthalmic surgeons iridencleisis is still a relatively new and untried operation. It is interesting to note that de Grosz makes no mention whatever of iridencleisis in his review of the surgical treatment for glaucoma in the Budapest clinic. Yet the results from this operation will compare favorably with those from any other; its use is rapidly increasing; and it is particularly to be recommended as applicable to nervous and unruly patients and in the hands of those who perform a relatively limited number of major operations upon the eye.

William H. Crisp.

BOOK NOTICES

Experimentelle Studien über den Verlauf der Tuberkulose im Kaninchenauge (Experimental studies on the course of tuberculosis in the rabbit eye); with remarks on tuberculosis of the human eye and on its relation to sympathetic ophthalmia. By Dr. Ilona Krasso, Vienna. Paper covers, 138 pages, with 35 re-

productions in the text and on a color plate. Price 8.80 marks. Verlag von S. Karger, Berlin, 1933.

This work, from the First University Eye Clinic of Vienna, is an outgrowth of Meller's studies on the relationship between tuberculosis and sympathetic ophthalmia (see editorial, American Journal of Ophthalmology, 1933, volume 16, page 247). The author aims chiefly to present precise knowledge as to the clinical course and histology of tuberculosis in the rabbit eye, more particularly in the presence of penetrating injury. Extremely varied lesions were obtained in any part of the uveal tract. Beside characteristic nodules with giant cells and necrosis, numerous sharply or vaguely limited infiltrates were encountered consisting of epithelioid cells and lymphocytes of varying proportions, from infiltrates consisting entirely of epithelioid cells to mere collections of lymphocytes. Thus purely lymphocytic foci may be of specifically tuberculous character.

In many of these rabbit eyes the demonstration of tubercle bacilli by staining in sections was difficult, and occasionally a series of sections had to be stained in order to find any bacilli. The author insists that absence histologically of infiltrates typical for tuberculosis is no proof that the eye does not contain tubercle bacilli, and that on the other hand the absence of bacilli upon staining does not prove that the infiltrated tissue has nothing to do with tuberculosis.

In these experiments the occurrence of posttraumatic iridocyclitis was connected with tuberculous infection of the damaged area. But the author's comments as to the bearing of his experiments upon the possible relationship between sympathetic ophthalmia and endogenous tuberculosis are inconclusive. W. H. Crisp.

Les conjonctivites folliculaires (The follicular conjunctivitides). By V. Morax. Report presented to the 46th Congress of the Société Française d'Ophtalmologie, June 27, 1933. Paper covers, 142 pages, 5 color plates outside the text (black and white illustrations in the text). Price not stated. Masson et Cie, Publishers for the Académie de Médecine, Paris, 1933.

The author, working in the tuberculosis laboratories of the Pasteur Institute of Paris, studied especially the relationship between trachoma, ordinary follicular conjunctivitis, and swimming pool conjunctivitis. His principal chapters are as follows: on the history of the subject; a series of clinical observations of swimming pool conjunctivitis with or without inclusion bodies and some of which were actually derived from swimming pool contagion while others arose in other places; etiology; description of a series of experiments in human inoculation from the swimming pool type of follicular conjunctivitis, as well as from the inclusion conjunctivitis of adults and of the newborn; pathologic anatomy; and diagnosis.

Swimming pool conjunctivitis differs essentially from trachoma by its relatively rapid evolution (in one to four months) and by the fact that it heals without corneal or palpebral sequels or complications. It is transmissible from man to man and is inoculable in certain monkeys, producing in these animals symptoms very analogous to those of the human subject after an incubation of from four to seven days.

This same infection may be observed in the newborn child, giving rise to a nongonococcic ophthalmia of the newborn which in a certain number of cases presents epithelial inclusions.

Under the special designation of chronic follicular conjunctivitis the author groups cases in which the evolution of the disease is slower than that of trachoma and longer than that of swimming pool conjunctivitis.

W. H. Crisp.

Collected reprints from the Wilmer Ophthalmological Institute of the Johns Hopkins University and Hospital. v. III. January 1932 to June 1933.

This third volume is a suitable companion for the previous two volumes,

containing about the same number of pages and being bound in similar manner. The contents cover a wide range of subjects of excellent worth, indicative of the character and scope of the department whence they eminate.

As the articles have appeared in recent periodicals and many of them have been abstracted in this Journal no mention of them individually will be attempted here. Lawrence T. Post.

CORRESPONDENCE

Editor, American Journal of Ophthalmology

Dear Sir:

Apropos of Dr. Hoffman's article on "Medical Economics" in the August issue of the Journal, I feel that "state medicine" is inevitable but that private practice will also continue and that possibly one-twentieth of the practitioners will eventually be still so engaged. I do not think the change will be sudden but gradual and that the profession and public will need and have ample time to make the necessary adjustments.

I understand that previous to about 1850 there were no public schools, academies or state universities; the conduct of education was on a private basis. The change to a public school and university system must have come very gradually but was inevitable. Yet private schools still exist. I imagine medical practice will go through a comparable change. It seems to me the two movements have a good deal in common, though of course the place which the average public school teacher and even the university teacher has in the community does not by any means equal that held by the average doctor and there may be other important differences. (Signed) E. V. L. Brown

ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is only mentioned in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. General methods of diagnosis
2. Therapeutics and operations
3. Physiologic optics, refraction, and color vision
4. Ocular movements
5. Conjunctiva
6. Cornea and sclera
7. Uveal tract, sympathetic disease, and aqueous humor
8. Glaucoma and ocular tension
9. Crystalline lens
10. Retina and vitreous
11. Optic nerve and toxic amblyopias
12. Visual tracts and centers
13. Eyeball and orbit
14. Eyelids and lacrimal apparatus
15. Tumors
16. Injuries
17. Systemic diseases and parasites
18. Hygiene, sociology, education, and history
19. Anatomy and embryology

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1. GENERAL METHODS OF DIAGNOSIS

Adrogue, E., and Lagos, J. **Perimeter and normal isopters.** Arch. de Oft. de Buenos Aires, 1933, v. 8, Jan. and Feb., pp. 51-54. (See Amer. Jour. Ophth., 1933, v. 16, June, p. 555.

Engelking, E. **Records of the course of dark adaptation.** Klin. M. f. Augenh., 1933, v. 91, Sept., p. 367. (Ill.)

Engelking describes charts for registering threshold values of light sense as obtained with the adaptometer of Nagel or that of Engelking and Hartung. (See American Journal of Ophthalmology, 1933, v. 16, page 556.)

C. Zimmermann.

Ferree, C. E., Rand, G., and Sloan, L. L. **Selected cases showing the advantages of a combined tangent screen and perimeter.** Arch. of Ophth., 1933, v. 10, Aug., pp. 166-184.

The perimeter is especially adapted for determination of limits of sensitivity in the peripheral field; the tangent screen for details of the central and paracentral portions. For the best results, both instruments should conform to similar test conditions, as to test object, illumination, pre-exposure and surrounding field, the distance of field and object, and the control of fixation. Such requirements can be obtained only through the use of a single instrument equipped for both methods of examination. The authors have equipped the Ferree-Rand perimeter with auxiliary tangent screens. M. H. Post.

Holzknecht, G. **Cranial radiology.** Rev. Oto-Neuro-Oft., 1932, v. 7, Oct., p. 415.

Since neither ophthalmologists nor other specialists interested in x-ray plates of the skull can hope to become experts in reading them, and since the cranial radiologist has so far not succeeded in meeting the problems of the four clinical fields interested (namely ophthalmology, rhinology, otology, and neurology), the creation of a clinical radiologic coordinator as intermediary for the four specialties is advocated as the best system for a large hospital.

M. Davidson.

Lijo Pavia, J. **Technique and results of cinematography of the fundus.** Klin. M. f. Augenh., 1933, v. 91, Sept., p. 403. (Ill.)

The apparatus is illustrated and described. With twenty-five exposures per second the pulsation of the retinal arteries could be demonstrated in a per-

fectly natural manner. The number of pulse beats per minute ascertained with the watch served as control. Especially sensitive modern films are essential for success. Some factors for further improvement are mentioned.

C. Zimmermann.

Strampelli, B. **The diplometer, an apparatus for the examination and measurement of diplopia.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 468.

The author states that the instrument is also useful in the study of the fusion sense and in the study of heterophoria. The article is well illustrated.

Phillips Thygeson.

Viallefont, H. **The value of determination of the red-blood-cell sedimentation rate in ophthalmology.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 438.

Viallefont finds the speed of red-cell sedimentation increased in syphilis, tuberculosis, and all acute uveal inflammations. Cataract, simple glaucoma, retinal detachment, and other conditions did not modify the rate. Increase in sedimentation rate should be considered a danger signal and appropriate complementary examinations should at once be instituted.

Phillips Thygeson.

2. THERAPEUTICS AND OPERATIONS

Beauvieux. **The treatment of follicular tuberculosis of the eye by methylic antigen.** Arch. d'Opht., 1933, v. 50, Aug., p. 450.

Noting the favorable results reported from treatment of joint, cutaneous, and other types of superinfective tuberculosis with the methylic antigen of Nègre and Boquet, it was decided to use it in ocular tuberculosis. In two cases in which actual tubercles were present in the anterior segment, and in one of which enucleation had been first advised, treatment with this antigen effected complete cure. Building up the general condition at a health resort was considered also of great assistance in these patients. M. F. Weymann.

Esser, L. **Influence of thorium X-Degea on rabbits' eyes.** Arch. f. Augenh., 1933, v. 107, May, p. 202.

Subconjunctival injection of thorium-X solution produced great change in the structures of the eye. Small doses in the form of ointment could be used over long periods (102 days) without damage. In higher concentration, there was definite injury in from ten to twelve days. In general, the effects on rabbit eyes corresponded with the well-known reactions produced by x-ray and radium. Frederick C. Cordes.

Gallenga, R. **On photodynamic treatment of pneumococcic infections of the eye.** Bull. Soc. Franç. d'Ophth., 1932, 45th year, p. 457.

Gallenga studied the effect of photodynamic treatment in experimental pneumococcic infections of the rabbit cornea with a virulent culture of type 4. The right eye was covered to shield it from light while the left eye was first treated with one percent mercuribromfluorescein (Merck) and then radiated with white light. In the treated eye the corneal ulceration was always promptly arrested while in the untreated eye the process usually progressed to perforation of the globe. Neither the fluorescent substance nor the light when used separately had any effect. When trypaflavine was introduced into the veins and the eye irradiated, the healing effect was less marked but still present. Phillips Thygeson.

Gonzalez, J. de J. **Intracutaneous reaction to nonspecific proteins in the prognosis of ocular lues.** Rev. Cubana Oto-Neuro-Oft., 1932, v. 1, Sept.-Oct., p. 293.

In the past the writer has always used milk injections in cases of resistant lues to overcome resistance to specific treatment, with most happy results. Recently the prognostic intracutaneous test of Dujardin-Decamp (hemostil) has been used by him for the same purpose with valuable results. In two of the six illustrative cases no allergic reaction was secured and treatment was of no avail, while in four cases the reaction was positive and specific treatment successful. The reaction is repeated until positive or abandoned after four negative results. In acquired lues

thirty-six percent are found nonallergic and about six percent remain so, while in hereditary lues eighty percent are nonallergic and about thirteen percent remain so. The injection provokes, if positive, a positive Wassermann sometimes, and reaction to treatment in all cases. M. Davidson.

Heath, Parker. **Ocular lipid histiocytosis and allied storage phenomena.** Arch. of Ophth., 1933, v. 10, Sept., pp. 342-364.

The author defines histiocytosis as "the immune reactions of intermediate metabolic tissue having properties of phagocytosis prominent in inflammation." By storage he means "the reactions following intracellular accumulations chiefly leading to fibroblastic proliferation and scar." Mesodermal phagocytozing cells are derived from vascular exudation. Attracted to the injured tissue, they produce further destructive lesions and their inflow, while defensive and protective, may become overwhelming and harmful. After the ingestion of large amounts of lipid, pigments, and cellular débris, motile cells become fixed and stored, the eventual result being fibroblastic proliferation and scar. The response varies with the hereditary and constitutional background, the age of the patient, the kinds and properties of intracellular substances, and the tissue implicated. In the young, the storage tends to be diffuse; in the older, circumscribed. The whole process is gradually becoming better understood along experimental, chemical, and clinical lines. The course of such reactions in many of the highly differentiated tissues of the eye is briefly outlined. While basic similarities in all tissues can be observed, the cellular and humoral defense reactions in the different structures are beginning to be understood.

M. H. Post.

Lacat, C. **The advantages of injections of lactoprotein in certain diseases of the eye.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 461.

Since 1922 Lacat has treated with milk injections 260 cases of intractable eye disease including hypopyon ulcer, serpent ulcer, acute iritis, and episcleritis. The results have been excellent, but he believes that lactoprotein is more valuable than whole milk because it is more easily standardized and the resulting reaction more readily controlled. Phillips Thygeson.

Nakamura, B. **Specific treatment of ophthalmic tuberculosis with a new tuberculosis vaccine.** Arch. of Ophth., 1933, v. 10, Aug., pp. 161-165.

The practice of gradually increasing the dose appears illogical, and better results have been obtained by adhering to the initial dosage. Best results have been obtained by use of "AO", a new vaccine discovered by Arima and Aoyama. One c.c. of "AO" number one is administered once a week and not increased at succeeding treatments. Reaction should be carefully avoided. The preparation now used is from tubercle bacilli of the human type, is sterile, and consists of the native protoplasm of the bacilli. It is easily absorbed, completely innocuous, and uniform in potency. It may be used for prophylaxis, diagnosis, and therapy. M. H. Post.

Nicolich, M. **What should not be forgotten about ocular antiseptics.** Rev. Cubana Oto-Neuro-Oft., 1932, v. 1, May-June, p. 162. (See Amer. Jour. Ophth., 1932, v. 15, Feb., p. 163.)

Poos, F. **The general conditions of action in ophthalmologic pharmacotherapy.** Klin. M. f. Augenh., 1933, v. 91, Sept., p. 346.

Knowledge of variability as to the effect of dosage and other details allows the surgeon to individualize as to dose and mode of application.

C. Zimmermann.

Schornstein, Theodor. **The newer local anesthetics in ophthalmology.** Zeit. f. Augenh., 1933, v. 80, May, p. 234.

After a review of the opinions expressed in the literature and some experiments as to time of onset of anesthesia and its persistence, as well as the effect of the drug on cornea, pupil, and accommodation, the author concludes

that pantocaine and larocaine are satisfactory drugs for superficial anesthesia. Extensive clinical use has led him to prefer cocaine for intraocular operations. F. Herbert Haessler.

Stallard, H. B. **Radiant energy as (a) a pathogenic, (b) a therapeutic agent in ophthalmic disorders.** The Gifford Edmonds prize essay for 1932. Brit. Jour. Ophth., 1933, v. 17, Monograph supplement 6.

This essay, of 126 pages, discusses radioactivity in relation to malignant and benign growths, and to certain types of inflammatory disturbance of lids and eyeball. In the treatment of malignant intraocular neoplasm, particularly sarcoma of the choroid and glioma of the retina, the interstitial insertion of a radon seed is the method of choice. For angiomatosis retinae the suturing of radon seeds to the sclera over the site of the neoplasm was found effective. For epibulbar neoplasms well localized and not extending widely around the limbus "contact" irradiation with an unscreened applicator for a short duration is better than other methods. By this means beta rays, which have a relatively short range, are employed mainly; as the prolonged application of screened radium emitting only the deeper penetrating gamma rays is likely to cause damage to the lens. For neoplasms which are exuberant or infiltrate deeply, surgical removal with a diathermy knife followed by irradiation is a more certain means.

As to the orbit, lymphosarcoma is particularly radiosensitive, and good results have followed when radium was applied to the affected site after thorough excision of a well localized sarcoma near the anterior part of the orbit and not attached to the bone. Malignant neoplasms affecting the bony walls of the orbit are exceedingly difficult to treat with radium, and osteonecrosis is a serious complication. If access to the neoplasm is difficult and the vision seriously affected, exenteration of the orbit followed by irradiation is to be preferred.

Also discussed are the radium treatment in vernal conjunctivitis, in hemangiomata of lids, conjunctiva, and caruncle, in Mooren's ulcer, keratitis, cataract, blepharitis, blastomycosis, sycosis of the lid margins, conjunctival pemphigus, trachoma, pinguecula, and pterygium. D. F. Harbridge.

3. PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Adrogue, A., Courtis, B., and Sena, J. A. **Actual state of the treatment of myopia. Can myopia be corrected without glasses?** Arch. de Oft. de Buenos Aires, 1933, v. 8, March, pp. 104-111. (See Section 18, Hygiene, sociology, education and history.)

Bichelonne. **A new unbreakable correcting lens.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 466.

Bichelonne describes a new unbreakable lens called "aclastos," and consisting of two thin layers of glass between which is cemented a layer of acetate of cellulose. Phillips Thygeson.

Biffis, A. **Influence of the aspheric form of the surface of the crystalline lens on spherical aberration of the globe.** Ann. di Ottal., 1933, v. 61, May, p. 367.

Taking into account the fact that the refrangent surface of the human lens is paraboloid, the author has calculated the spherical aberration of the eye. He concludes that in the schematic eye the paraboloid lens is not free from spherical aberration but that this is of a lesser degree than in the schematic eye in which the surface of the lens is spherical in form. (Bibliography.)

Park Lewis.

Colajanni, G. **Researches as to the Rayleigh equation with the Nagel anomaloscope in demonstrating relative daltonism.** Ann. di Ottal., 1933, v. 61, Feb., p. 99.

The author briefly reviews modern views on color anomalies, and gives tables showing the result of examination of seventy-nine candidates as aërial pilots. He discusses the value of the spectroscope for demonstrating relative dyschromatopsia in applicants for the

flying, the marine, and the railroad services. (Bibliography.)

Park Lewis.

De Mets. **The Belgian method of treating deaf-mutes.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 46.

In place of isolated phonetic elements the young deaf-mutes are taught words and sentences in their entirety. Education is begun at five to six years or earlier and the use of sign language is discouraged. The young child is first taught to read, then to read lips, and finally to speak. Phillips Thygeson.

Dufour, Marcel. **On the theory of correcting lenses giving punctual images.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 57. (See also Amer. Jour. Ophth., 1933, v. 16, June, p. 558.)

Ferree, C. E., and Rand, G. **Interpretation of refractive conditions in the peripheral field of vision.** Arch. of Ophth., 1933, v. 9, June, pp. 925-938.

Graphs are constructed and interpreted for a large number of cases. The many interesting problems discussed include: the possibility of determining in cases of refractive asymmetry whether the defect is in the refractive system and its relation to the axis of vision or the conformation of the retina, the shape of the eyeball, or both of the latter taken together; possible explanation of failure substantially to improve vision by glasses in certain cases which show no central scotoma but marked asymmetric refraction in the peripheral field; the possibility that asymmetric refraction may be responsible for ocular deviation in certain cases; the possibility of outlining the conformation of the retina and the shape of the posterior half of the eyeball; and the possibility of determining the comparative length of the eyeball and the strength of the refractive system, and of drawing conclusions with regard to the relative importance of the two factors in hyperopia and myopia.

M. H. Post.

Gallenga, R. **Observations upon the light sense at high altitudes.** Rassegna Ital. d'Ottal., 1933. v. 2, March-April, p. 345.

Gallenga studied the light sense in twenty-four subjects at an altitude of 3,000 meters. The tests were made with the Birch-Hirschfeld apparatus and upon individuals between eighteen and thirty-five years of age. After general fatigue during the daytime there was marked increase of the threshold value as compared with conditions of complete rest, but this was not found after nocturnal fatigue. This is probably due to lessened loss of retinal substances with low illumination.

Eugene M. Blake.

Hornbogen, D. P. **A cross cylinder for determining axis.** Amer. Jour. Ophth., 1933, v. 16, Oct., p. 902.

Lemoine, P., and Valois. **Is there a disease "myopia"? Ectatic sclerochoroiditis, etiology and treatment.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 64. (See Amer. Jour. Ophth., 1933, v. 16, Aug., p. 746.)

Mendoza, R. **Errors in physiologic optics.** Arch. de Oft. Hisp.-Amer., 1933, v. 33, July, p. 427.

Errors in physiologic optics are found even in the latest text books. Examples are: According to Fuchs, a peripheral artificial pupil, in the presence of a central corneal opacity, does not compel deviation of the eye to place the pupil in the visual line, the image continuing to fall on the fovea but dimmed. But clinical observation, when the two eyes are involved, shows deviation, and the reason is found in the prismatic effect of the lens periphery. Fuchs' statement that the presence of two pupils in one eye does not cause monocular diplopia is not borne out by clinical observation. Duke Elder's statement that light coming from large surfaces is concentrated in the lens is erroneous, as all light is concentrated on the retina. There is a common confusion between solid vision resulting monocularly from superposition of various images of the same object in the same eye and without depth perception, and depth, or spatial, or distance perception, which may exist

without solid vision and is secured only binocularly. The distinction is easily brought out by projecting a red figure on a white or black background, which produces solid vision but no depth feeling when seen monocularly, and then projecting the same figure on a blue background and viewing it binocularly, when depth is perceived but no solidity. Correction of biastigmatism and cylinder skiascopy are not justified practically. M. Davidson.

Meyer, L. L. **Congenital reading disability—strephosymbolia:** Report of five cases of partial word blindness. Jour. Amer. Med. Assoc., 1933, v. 100, April 15, p. 1152.

The outstanding features of strephosymbolia as illustrated in the five cases reported are: (1) difficulty in differentiating the lower-case letters, p and q, and b and d; (2) a striking tendency to confuse palindromic words such as was and saw, not and ton, and to reverse paired letters or even whole syllables or words in reading, so that they are read from right to left instead of from left to right; (3) a considerable degree of capacity to read from a mirror, and (4) a greater facility in producing mirror writing. Another outstanding feature is ocular dominance, and the author holds that it is important to determine the dominant eye. All five of the author's little patients responded splendidly under special tutoring by experts in mental hygiene and child behaviorism. The literature is reviewed.
George H. Stine.

Pacalin, G. **Binocular vision of relief.** Arch. d'Opht., 1933, v. 50, July, p. 460.

Diagrams accompanied by detailed explanation are used to demonstrate that visual depth perception is due solely to parallactic displacement. Even though fusion takes place the parallactic displacement is still the factor which gives the sensation of relief. The writer deplores the fact that more textbooks are not illustrated by stereoscopic pictures and diagrams, because the average individual can learn to dissociate his convergence and accommodation sufficiently to obtain a stereoscopic effect from such illustrations without the use of any mechanical device.
M. F. Weymann.

Padovani, S. **A case of elevated hypermetropia.** Arch. di Ottal., 1933, v. 40, April, pp. 145-149.

The author describes a very rare case of high hypermetropia with oblique astigmatism, which reached a maximum of +22 diopters in one of the principal meridians. The eyes had the characteristics of microphthalmos.
Herman D. Scarney.

Pascal, J. I. **The ioskiascopy test—simplified.** Arch. of Ophth., 1933, v. 10, July, pp. 58-62.

The author cites a few advantages of the ioskiascopy test, and a simplified method for its use. M. H. Post.

Pascal, J. I. **Stereoscopic exercises in ametropia: a new use of the stereoscope for developing tolerance to the lenses correcting errors of refraction.** Arch. of Ophth., 1933, v. 9, June, pp. 952-956.

By using the stereoscope in connection with the correcting glasses, accommodation may be overstimulated enabling the readjustment to take place more rapidly than under normal conditions. A like influence occurs following correction of myopia. The method for carrying out these exercises is described in some detail.
M. H. Post.

Robert, Georges. **The influence of ametropias on certain infections of the ocular adnexa.** Ann. d'Ocul., 1933, v. 170, Aug., pp. 663-683.

The author quotes Lagrange as emphasizing the necessity of good refraction as a basis for treatment of diseases of the eye. The argument is supported by examples of blepharitis, chalazion, conjunctivitis, and other conditions in which either recovery was hastened after proper correction of ametropia or the efficacy of other forms of treatment was enhanced. H. Rommel Hildreth.

Thorson, J. A. **Myopia in alkalosis from Sippy treatment.** Arch. of Ophth., 1933, v. 10, July, pp. 20-24.

On November eighteenth the patient's refraction under homatropin showed emmetropia, with vision of either eye 20/20. Shortly the patient was placed on the Sippy régime for peptic ulcer. On December tenth he rather suddenly noted failure of distant vision, O.D. 20/24, O.S. 20/50. Examination revealed refraction O.D. and O.S. minus 0.75 sphere minus 0.25 cylinder axis 180 degrees; vision 20/20 in either eye. At this time dust-like opacities were noted in the outer third of each lens. The calcium carbonate was reduced and ten days later the vision of either eye without correction was 20/20. Recurrence of gastric symptoms again necessitated administration of large doses of calcium carbonate, and two days later the vision of the right eye was 20/25 without correction, rising to 20/15 with minus 0.50 sphere; that of the left eye 20/100 without correction, and 20/15 with minus 1.00 sphere. After a gastroenterostomy with uneventful recovery, the vision on February fifteenth was 20/15 either eye without correction, and the dust-like opacities in the lens had disappeared.

The author concludes that the myopia resulted from swelling of the lens due to depletion of the chloride content of the blood. M. H. Post.

Verhoeff, F. H. **A new test for visual acuity.** Arch. of Ophth., 1933, v. 10, Aug., pp. 226-230.

The author here suggests a new type of test chart of great simplicity and accuracy, consisting essentially of two figures repeated on eight lines and graduated as are the Snellen charts, but having an additional gradation corresponding to a visual acuity of 20/12.5. The figure on the left consists of two, that on the right of three concentric rings. The diameters of the outside rings on the same line are equal. The thickness of the circular bands on the left hand figure and the white interval between them subtend an angle of one minute on the retina at the distance indicated, except that the outer ring is very slightly broader than the inner, a difference found necessary to make both appear alike. Those on the right hand figure are somewhat narrower. In testing, the patient indicates on which line the two images look alike and his visual acuity is recorded as that of the line above. Uncorrected astigmatism is easily recognized by blurring of certain parts of the circumference of the circles. M. H. Post.

Wechsler, I. S. **Partial cortical blindness with preservation of color vision. Report of a case following asphyxia (carbon monoxide poisoning?); a consideration of the question of color vision and its cortical localization.** Arch. of Ophth., 1933, v. 9, June, pp. 957-965.

The case was rare in that color vision was preserved in the presence of partial cortical blindness following carbon monoxide poisoning. No pathological study was possible, but analysis of the symptoms indicated the lesion to be predominantly, though not exclusively, cortical. There appeared to be a disturbance of symbolic thinking, that is, the patient saw objects without being able to recognize and name them, especially if small. The probable explanation is that certain parts of the cortex or the layers presumed to perceive and elaborate color vision escaped or recovered. M. H. Post.

Williams, R. D. **A possible explanation of one type of color blindness.** Amer. Jour. Ophth., 1933, v. 16, Sept., pp. 803-806.

4. OCULAR MOVEMENTS

Alcorn, J. G. **Linear measurement of strabismus.** Amer. Jour. Ophth., 1933, v. 16, Oct., p. 898.

Bahr, C. **The eye and vegetative neurosis.** Klin. M. f. Augenh., 1933, v. 91, Sept., p. 371.

The "vegetative neurosis" is due to heterophoria. Suitable prisms are recommended. C. Zimmermann.

Coppez, H. **Some cases of ocular synkinesis.** Bull. Soc. Franç. d'Opht., 1932, p. 411.

Coppez describes five cases of ocular synkinesis. In the first case a complete left third-nerve paralysis was followed

by what the author calls a pseudo-Graefe sign. In the primary position of the eyes there was slight divergence. In the upper quadrants neither the eye nor the lid could be elevated. In the lower quadrants the eye turned down but the lid became elevated. The theory is advanced that in the process of regeneration of the nerve certain fibers destined for the internal and inferior recti became diverted to the levator muscle. The second case was one of congenital absence of lateral movements of one eye. The syndrome, which the author calls the syndrome of Stilling, consisted essentially of enophthalmos, manifested particularly in adduction, and inability of the eye to turn laterally. Adduction was replaced by marked upward movement. The author considers the lesion an orbital one, consisting of muscle degeneration. The third case was similar to the second. The fourth was a classic example of Marcus Gunn syndrome, which consists of association of the movements of elevation of the upper lid and of dropping the lower jaw. The fifth case followed peripheral paralysis of the right seventh nerve. After some months the paralysis became spastic and motility returned over the lower portions of the face. Winking of the eyes was accompanied by slight contraction of the ala of the nose on the paralyzed side. When the patient smiled or uncovered the teeth there was an associated blepharospasm.

Phillips Thygeson.

Curdy, R. J. **The recession operation for strabismus.** Amer. Jour. Ophth., 1933, v. 16, Oct., pp. 890-893.

Eber, C. T. **Ocular crisis.** Jour. Missouri State Med. Assoc., 1933, v. 30, June, p. 241.

This paper consists of reports of oculogyric crises in two twenty-year-old women. (Two references.)

Ralph W. Danielson.

Fisher, J. H. **Report of two cases of nystagmus.** Trans. Ophth. Soc. United Kingdom, 1931, v. 51, pp. 228-232.

A child of seven months was hit behind the right ear. The next day the mother noticed that both eyes deviated to the right, occasionally to the left. A week later jerky movements of the right eye were noticed, and they began in the left eye three weeks later. There was no head-nodding and the media and fundi were normal. There was no albinism in the family. In a second child, eight months old, congenitally syphilitic, for two weeks the mother had noticed both eyes turned to the right and the left eye jerking. A week later the left nystagmus was greater and the right eye began to be nystagmic; also some head nodding began. The patient was put on gray powder and in three months all the symptoms had disappeared. The author thought the lesion was in the pons.

Thomas D. Allen.

François, Jules. **On the pyretotherapeutic treatment of ophthalmoplegia interna of tabetic origin.** Bull. Soc. Belge d'Opht., 1933, no. 66, p. 68.

A case of ophthalmoplegia interna in a woman of thirty-nine years not only failed to improve under antisyphilitic treatment (mercury and bismuth) but progressed and became bilateral. Under pyretotherapy there was rapid and complete cure. The antisyphilitic treatment caused improvement in the general condition of the patient though it failed to stop the progress of the ophthalmoplegia. Most authors state that while malaria therapy ameliorates the paralytic symptoms of general paralysis in an important number of cases, it leaves intact the tabetic signs and especially the pupillary symptoms of tabes. Pyretotherapy by means of chemical agents is most often induced with sulphur and the author used sulfosine, a one percent emulsion of sulphurated oil, giving deep intramuscular injections beginning with 1 c.c. One should try to obtain temperatures of 40 to 40.5 Centigrade (102 to 102.9 Fahrenheit) and it is not necessary to give a dose greater than 3 c.c. to obtain the optimum temperature. Six injections were given during two weeks.

About fifteen hours after the fourth injection the patient noticed distinct improvement in visual acuity and was able to read without effort. About one

month later the pupils were normal and equal, and the pupillary reactions, accommodation, and visual acuity normal in both eyes. J. B. Thomas.

Gonzalez, J. de J. **Monosymptomatic ocular hysteria. Spasm of convergence and accommodation.** Rev. Cubana Oto-Neuro-Oft., 1932, v. 1, Sept.-Oct., p. 323.

A girl of eighteen years, an emmetrope and free from strabismus, after working intensively for several days at retouching photographs in dark room, presented herself with a paralytic convergent strabismus with marked bilateral limitation of temporal fields in binocular fixation, but with no limitation of fields in monocular fixation. There was also a myopia of three diopters in either eye. The hysterical nature of the condition was demonstrated by its disappearance in two weeks under the writer's "armed psychotherapy" treatment (which consisted of a galvanic current of three milliamperes and exercises with Terrien's sinoscope) as well as by its reproduction and repeated cure by suggestion. The case is considered as one of psychic trauma responsible for loss of control of cortical centers of convergence and accommodation. M. Davidson.

Yanes, T. R. **A case of paralysis of vertical movements.** Rev. Cubana Oto-Neuro-Oft., 1932, v. 1, Sept.-Oct., p. 313.

A girl of twelve years with a prenatal history of serious toxemia of pregnancy, presented since birth bilateral paralysis of the elevators, and the superior and inferior recti, as well as paralysis of the right internal rectus. The question of localization of the lesion is discussed in detail. A midbrain lesion at the level of the anterior quadrigeminate bodies is held most likely. But not all phenomena are explicable on such a basis, and the possibility of peripheral nuclear associations participating in the supranuclear coordinating midbrain centers, as suggested by Ferreol, Duval, Graux, Gaussel, and Bernheim, is to be considered in explanation of conjugate paralyses. (Illustrated.)
M. Davidson.

5. CONJUNCTIVA

Angelucci, A. **The effect of pigment on the adenoid state and trachoma in relation to race.** Rev. Cubana Oto-Neuro-Oft., 1932, v. 1, Sept.-Oct., p. 287.

The author thinks that the rôle of retinal pigment is to neutralize and oxidize tissue acidosis resulting from the action of light on the retina, and that retinal oxidation on exposure to light is accompanied by increased cerebral oxidation. He has found a correlation between susceptibility to trachoma and skin pigmentation. The greater the pigmentation the less the susceptibility to trachoma, as well as to calcium deficiency, lymphatism, and acidosis.
M. Davidson.

Ebert, R. O. **Large retention cyst of conjunctiva.** Amer. Jour. Ophth., 1933, v. 16, Oct., p. 900.

Glover, D. M., and Jacoby, M. W. **Reconstruction of a conjunctival sac with Thiersch grafts.** Arch. of Surgery, 1933, v. 26, April, p. 617.

The authors give technique for restoring a conjunctival sac obliterated by injury from caustic solution.
Ralph W. Danielson.

Julianelle, L. A., and Harrison, R. W. **Transmissibility of trachoma to monkeys.** Amer. Jour. Ophth., 1933, v. 16, Oct., pp. 857-862.

Kutznetskaya, E. D. **Trachoma: treatment with chaulmoogra oil.** Arch. of Ophth., 1933, v. 10, Sept., pp. 375-378.

Attempts were made to determine whether the reports of Delanoë concerning the treatment with chaulmoogra oil of 25,000 patients having trachoma could be substantiated. The previous report, however, was admittedly incomplete in that the conditions of Delanoë's work were such that she was not able to trace the final results.

Treatments were conducted according to her method, and also in association with various copper salts. The author of this paper concludes that chaulmoogra oil is not specific for trachoma, and that the good effects observed from its use were due, in part,

to the method of application. He further determined that its combination with copper salts gave no better results, except as the ointment of chaulmoogra-copper salt. In this latter form it aided considerably in the resolution of pannus, but gave no lasting result. Other combinations with copper proved more irritating to the eye than the chaulmoogra oil alone. M. H. Post.

Lusza, A. **The blood picture of trachoma patients.** Klin. M. f. Augenh., 1933, v. 91, Sept., p. 400.

Lusza found in the majority of eighty-six trachoma patients a lymphocytosis of over thirty percent. He considers from thirty to forty percent characteristic of the blood picture of most trachoma patients. The lymphocytosis was increased during treatment and even in clinically cured patients.
C. Zimmermann.

Olitsky, P. K., and Tyler, J. R. **Studies on the etiology of spontaneous conjunctival folliculosis of monkeys.** Jour. of Exper. Med., 1933, v. 57, Feb., p. 229.

The Macacus rhesus monkey is ordinarily employed for experimental transmission of human trachoma and for study of the inoculation effects of organisms derived from trachomatous tissues. There occurs, however, among certain stock monkeys, spontaneous conjunctival folliculosis which may simulate the experimental disease induced by inoculation of suspensions either of human trachomatous tissues or of Bacterium granulosis. This folliculosis is apparently a disease sui generis. It can be transmitted from monkey to monkey by subconjunctival injection of suspensions, and by conjunctival swabbing of the secretions of affected tissues, or by contact of normal animals with folliculosis monkeys. (Sixteen references.) Ralph W. Danielson.

Stilo, A. **A contribution to the morphology, chemistry and histo-chemistry of Harder's gland and its biologic significance.** Ann. di Ottal., 1933, v. 61, June, p. 453.

In certain of the black races as well as in some of the lower animals a gland is found at the inner angle of the eye compressed by the plica semilunaris that has the microscopic appearance of and is similar to the nictitating gland of the rabbit, the pig, and the mouse, but which is absent in the guinea pig and the rat. This gland is considered as phylogenetically homologous to the nictitating gland and it is thought probable that it is one of the endocrines. Morphologically the gland is more nearly allied to the parotid than to the lacrimal. (Colored plate, bibliography.)
Park Lewis.

Villard, H., and Dejean, C. **A morphological study of pterygium with the slitlamp.** Arch. d'Opht., 1933, v. 50, Aug., p. 533.

From the fact that the advancing edge of the pterygium shows a palisade formation similar to that of the normal limbus, the writers consider pterygium as a localized advancement of the corneal limbus in the region of the palpebral fissure, probably caused by the influence of dust, wind, or other factors causing chronic irritation.
M. F. Weymann.

6. CORNEA AND SCLERA

Ayuyao, C. D. **Corneal lesion in beriberi.** Jour. Philippine Islands Med. Assoc., 1933, v. 13, March, p. 158.

Ayuyao has seen the corneal manifestation of beriberi exclusively in women during the last months of pregnancy or a few weeks after labor. There are blurring, slight photophobia, and lacrimation, but neither pain nor tenderness. Always both eyes are affected. The pupillary reflexes are present. To biomicroscopy, the superficial epithelium appears uneven, showing irregular undulations here and there. The swollen portions are amyloid in appearance but transparent. There is no cellular infiltration or anything that might indicate an active inflammatory process. The deeper layers are not involved. This peculiar condition is probably due to an affection of the ophthalmic branch of the trigeminal nerve. The visual acuity gradually returns with improvement in the beriberi symptoms. (Three case reports.)
Ralph W. Danielson.

Baratta, O. **Comparative histologic researches concerning the principal methods of tattooing corneal leucomas.** Arch. di Ottal., 1933, v. 40, April, pp. 180-202.

The author reviews the agents more commonly used for tattooing the cornea, and he has made a microscopical study of the results of tattooing with India ink, gold chloride, platinum chloride, silver nitrate, silver nitrate plus gold chloride, silver nitrate plus sodium polysulphide, and lead subacetate plus sodium polysulphide. He describes Jasinksi-Mieciclas' use of lead subacetate, silver nitrate, or copper sulphate, shortly afterward touching the scarified cornea with sodium sulphide or sodium polysulphide. He believes that the chemical are far superior to the mechanical methods.

Herman D. Scarney.

Berliner, M. L. **Herpes corneae occurring after artificial hyperpyrexia induced by diathermy.** Arch. of Ophth., 1933, v. 10, Sept., pp. 365-367.

Two cases are reported showing the condition indicated by the title of this paper. The first case showed in the right eye at about twelve o'clock, one millimeter from the limbus, four groups of small, superficial, grayish lesions, arranged in the form of an arc. These stained readily with fluorescein. They were first noted two days after the treatment, and four days later had subsided, leaving several groups of small, discrete opacities, just behind the corneal impact line. The photophobia, pain, and lacrimation subsided about the seventeenth day. Coincident with these corneal lesions, herpes labialis was noted, which disappeared on the eleventh day. The second case was similar in all respects. The author suggests that some persons may harbor in the body in an inactive form the virus of herpes which only awaits a favorable stimulus, such as fever, to initiate an outbreak. M. H. Post.

Burnham, G. H. **Respective values of the various forms of treatment of certain diseases of the cornea.** Arch. of Ophth., 1933, v. 10, Aug., pp. 231-236.

The author recommends what he terms "combined treatment," hypodermic administration of pilocarpin and internal use of mercury and sodium iodide with sodium bromide, for ulcers of the cornea, calcareous cornea, conical cornea, interstitial keratitis, keratitis profunda, and other conditions.

M. H. Post.

Denig, Rudolf. **Tuberculous sclerokeratitis.** Amer. Jour. Ophth., 1933, v. 16, Oct., pp. 899-900.

Fage, M. **Variability of forms of herpes of the cornea.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 130. (See Amer. Jour. Ophth., 1933, v. 16, Jan., p. 79.)

François, Jules. **Chronic edema of the cornea.** Arch. d'Opht., 1933, v. 50, Aug., p. 549.

The vision of the right eye of a fifty-two-year-old man had been blurred for two years, most in the mornings. Examination showed only edema of the corneal epithelium with occasional formation of bullae. The other eye was normal as were the general physical findings. Medical tarsorrhaphy was followed in eight days by complete clearing. The lids were left closed for six weeks, and the corneal epithelium has since remained normal for five months. It is believed the edema was due to trophic disturbances from chronic neuritis which was cured by the constant protection afforded after tarsorrhaphy. M. F. Weymann.

Kayser, B. **Anatomical measurements of the eye with megalocornea.** Klin. M. f. Augenh., 1933, v. 91, Sept., p. 343.

In a previous article (see American Journal of Ophthalmology, 1933, volume 16, page 943), Kayser asserted that it seemed to him certain that as a rule the eyeball was of normal size apart from the megalocornea. This was chiefly based on his twenty-two years' observation of a patient who has since died of an intercurrent disease. The eyeball was removed twelve hours after death and showed the following dimensions: vertical diameter 24 mm., frontal 24.5

mm., sagittal 27 mm., corneal diameter 14 by 14.5 mm., depth of anterior chamber 7.5 mm. This confirms the author's opinion. C. Zimmermann.

Koch, C. **Differences in the behavior of tattooed corneas of growing and adult rabbits.** Klin. M. f. Augenh., 1933, v. 91, Sept., p. 382. (Ill.)

Koch drew with Elliot's trephine dipped in India ink a central and four more peripheral circles tangent to it in the corneae of albinotic rabbits from eight to ten days old, and also of adult albinotic rabbits, and compared the results histologically. The particles of India ink spread in the parenchyma of the cornea of the young animal, but showed no migration in the adult. The author attributes this to the differences in micellar structure of the young and old corneas. C. Zimmermann.

Long, E. R., Holley, S. W., and Vorwald, A. J. **A comparison of the cellular reaction in experimental tuberculosis of the cornea in animals of varying resistance.** Amer. Jour. of Pathology, 1933, v. 9, p. 329.

Central interlamellar corneal injections of moderately virulent tubercle bacilli of human type were made in a series of normal and tuberculous guinea pigs, and normal rabbits and cats, and the nature and extent of the inflammatory response determined by microscopic examination post mortem. In all cases the first reaction noted was at the limbus, and not at the site of injection. The reaction consisted of an outpouring of polymorphonuclear leukocytes from the marginal vessels. At one month, the last period studied, the intensity of inflammatory reaction, as determined by the size of the lesion and the proportion of the cornea involved, was greatest in the guinea pig, less in the rabbit and least in the cat. This order is in inverse relation to the general resistance of these animals to the strain of tubercle bacillus used.

W. H. Crisp.

Long, E. R., and Holley, S. W. **The origin of the epithelioid cell in experimental tuberculosis of the cornea.** Amer. Jour. of Pathology, 1933, v. 9, May, p. 337.

The authors conclude that the primitive mononuclear cells, after accumulating in and around the capillary walls, underwent progressive transformation by simultaneous increase in size and change of character, without metastasis, into epithelioid cells. (Nine references and fourteen plates.)

Ralph W. Danielson.

Marx, E. **Researches upon the sensitivity of the cornea.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 116. (See Amer. Jour. Ophth., 1933, v. 16, Feb., p. 173.)

Satanowsky, P. **Keratitis punctata profunda. Familial nodular corneal degeneration.** Arch. de Oft. de Buenos Aires, 1933, v. 8, Jan. and Feb., pp. 55-60.

In two cases in brothers the corneal stroma was infiltrated with small grayish, whitish nodules, located chiefly nearer the epithelium at the pupillary area. Vision was considerably impaired. Both cases received general antiluetic treatment and local treatment with dionin and fibrolysin. One patient improved considerably, the other became worse in the course of the treatment. (Four illustrations.)

R. Castroviejo.

7. UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Arruga, H. **Experimental choroidal adhesions.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 203. (See Amer. Jour. Ophth., 1933, v. 16, May, p. 465.)

Huber, A. **Medicinal corelysis or synechotomy.** Arch. de Oft. de Buenos Aires, 1933, v. 8, May, pp. 210-230.

The author reports four cases of acute iritis of different etiologies, in which posterior synechia had been developed. Subconjunctival injections of glaucosan succeeded in liberating the iris from its adherence to the lens. Previously atropin had been used for the same purpose without success.

R. Castroviejo.

Lazarescu, D., and Lazarescu, E. **Neurogenic heterochromia of the iris and the Claude-Bernard-Horner syndrome.** Ann. d'Ocul., 1933, v. 170, Sept., pp. 767-771.

A forty-five-year-old man was injured on the left side of the neck with a bayonet during the war. The corresponding eye showed miosis, enophthalmos, and drooping of the lid. The pupil dilated with adrenalin and cocaine but did not respond to homatropin. The iris was greenish, while the iris of the fellow eye was clear brown. Experimentally in a rabbit heterochromia developed in the second month after removal of the cervical ganglion.

H. Rommel Hildreth.

Lee, F. H. **Disorders of motility of the iris:** report of case. Jour. Amer. Med. Assoc., 1933, v. 100, May 6, p. 1395.

The author reviews the various disorders of iris motility, and reports a case of Horner's syndrome which followed thyroidectomy. There were also severe sick headaches probably due to fatigue brought on by anxiety and spasm of the frontalis muscle. Correction of the refractive error, with mental hygiene, resulted in considerable relief from the symptoms. (One photograph.)

George H. Stine.

Machemer, H. **Contributions to the physiology and pathology of the pupil.** Klin. M. f. Augenh., 1933, v. 91, Sept., p. 302. (Ill.)

The apparatus described permits exact measurement of the pupil and registration of the movements of the iris, photographically and cinematographically. The errors of the apparatus are ± 0.075 mm. and ± 0.01 seconds.

C. Zimmermann.

Town, A. E. **Cyst of the uveal layer of the iris.** Amer. Jour. Ophth., 1933, v. 16, Sept., pp. 790-795.

8. GLAUCOMA AND OCULAR TENSION

Barrenechea S., A. **Inflammatory glaucoma without permanent hypertension.** Arch. de Oft. Hisp.-Amer., 1933, v. 33, Sept., p. 538.

A case of glaucoma in which there was persistent hypotension in the intervals between two attacks of hypertension but with persistence of redness, shallowness of anterior chamber, mydriasis and other evidence of glaucoma is reported. The darkness and homatropin tests had failed to elicit hypertension, and only the Charlin "night" test, that is, bandaging the eyes during the whole night and taking the tension the first thing in the morning, showed a difference of 10 mm. Hg. between evening tension and morning tension, the latter being 24 mm. Hg.

M. Davidson.

Kalt, Marcel. **Anatomical alterations in congenital hyrophthalmos.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 317. (See Amer. Jour. Ophth., 1933, v. 16, June, p. 562.)

Knapp, Arnold. **Operative treatment of chronic glaucoma; report of two hundred successive operations.** Arch. of Ophth., 1933, v. 10, Sept., pp. 298-301.

Two hundred operations were divided into groups as follows, according to the operation used: Lagrange 95, trephining 80, iridectomy 12, cyclodialysis 8, iridotasis 5. In 85 Lagrange operations there was filtration and in 10 the tension rose again. Two of the latter were trephined, filtration being had in both; in one cyclodialysis was practiced, but unsuccessfully. Of the 80 trephined, 60 obtained filtration; in 20 the tension rose again. Nine of these were again trephined, and in 7 filtration was obtained. Cyclodialysis was subsequently carried out in 4, but unsuccessfully. Of the 12 iridectomies, 5 obtained filtration; in 7 the tension rising again. Two of these were trephined with success in one. Filtration was obtained in five of the eight cases where cyclodialysis was the operation of choice. Iridotasis was successful in the five cases in which it was used. Cases for the Lagrange operation were selected. The other operations were performed only in cases that appeared unsuited for this procedure.

The author believes there are several satisfactory operations for chronic glaucoma, and that the operator should

select the one in which he feels most confidence. M. H. Post.

Pesme, P. **A case of infantile glaucoma with pseudoglioma of the retina.** Bull. Soc. Franç. d'Opht., 1932, p. 310.

Pesme describes in detail the histopathology of a case of infantile glaucoma with pseudoglioma of the retina. The retina was detached and was the seat of marked hemorrhagic and inflammatory lesions which had led to formation of a fibrous tissue tumor. The author refers to four similar cases reported in the literature.

Phillips Thygeson.

Saint Martin, de, and Meriel, P. **Glaucoma and mean tension.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 329. (See Amer. Jour. Ophth., 1933, v. 16, March, p. 269.)

Terson, A. **On the nature and the medicosurgical treatment of glaucoma.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 334.

Terson discusses in some detail the subject of the pathogenesis of glaucoma and identifies glaucoma with the edemata. Treatment should include general treatment. The glaucomatous individual should lead an inactive life. Associated diseases should be actively treated. The diet should have low salt, nitrogen, and cholesterin content, and fluids should be restricted. Diuretics and cardiac tonics are indicated. Sweats have no real value but prudent bleedings sometimes help. The author recommends the use of ergotamin by mouth as helpful in the majority of glaucomatous patients. In acute glaucoma the operation of choice is basal iridectomy, for which Terson outlines his technic. For chronic glaucoma the Lagrange operation is recommended.

Phillips Thygeson.

Vele, M. **The relation of arteriosclerosis to glaucoma.** Ann. di Ottal., 1933, v. 61, July, p. 511.

Fifty patients having glaucoma were examined as to blood pressure, the Ambard constant, and ocular tonus, and the results were compared with those from controls with normal ocular tension. The author's findings were that while in the glaucomatous there was a moderate increase proportionally in blood pressure, it was not justifiable to conclude that this was the sole cause of the glaucoma, and therapeutic measures should concern themselves not only with the hypertension but also the entire cardiovascular system.

Park Lewis.

9. CRYSTALLINE LENS

Berens, C., and Sitchevska. **Complete discission of the crystalline lens.** Amer. Jour. Ophth., 1933, v. 16, Sept., pp. 779-787.

Burky, E. L. **Relation of ocular sensitivity to the arthus phenomenon in the rabbit.** Arch. of Ophth., 1933, v. 10, Sept., pp. 368-374.

The author found that injury to the lens with escape of lens substance reacted in a similar manner in rabbits previously treated with lens extract and those not so treated. A number of rabbits so treated were tested also for anaphylactic reactions by intravenous and intracutaneous injections of lens substance, and were found to be nonreactive, even though they all had high precipitin titers. Guinea pigs, definitely anaphylactic, were subjected to needling operations on the lens. In this instance, there appeared to be greater reaction than in the normal animal. It was found that it was impossible to develop sensitivity to lens substance in the rabbit by the more simple procedures. This report details the results of experiments with beef serum antigenically very active, in an attempt to show that intraocular sensitivity can be developed in the rabbit, that this sensitivity is present only during the height of the arthus reaction, and that it is independent of the precipitin titer. The experiments reported in this paper, conducted with these questions in mind, show that an Arthus phenomenon and generalized hypersensitivity to beef serum can be produced, and that at the height of the reaction beef serum injected into the eye produces a reaction comparable to that found in the skin, but that after

disappearance of the Arthus reaction no such result can be obtained. Thus it is shown that a hypersensitive state must be attained in the experimental animal in order to produce ocular disease pictures which appear to be anaphylactic in origin. M. H. Post.

Hobart, Carl. **Protein extract of vitreous humor (bovine): preliminary report.** Arch. of Ophth., 1933, v. 10, Aug., pp. 237-240.

Hypersensitivity to vitreous humor protein exists in certain individuals, and in such individuals characteristic inflammatory reaction follows vitreous loss. The patient, if sensitive, should be desensitized before cataract extraction. M. H. Post.

Kirby, D. B. **Cataract and diabetes.** Arch. of Ophth., 1933, v. 9, June, pp. 966-973.

Because of the frequency of changes in refraction and the high incidence of cataract in diabetes, the author has chosen the relation of carbohydrate metabolism to lens opacities as likely to throw light on the etiology of cataract. He agrees with Duke Elder that lens changes in diabetes may appear as senile cataract developing at a relatively early age, or more rarely as a rapidly developing form of cataract peculiar to this disease. Sixty-four percent of the diabetic cases studied showed lens changes, of which seventy percent lay in the senile cortex. The severity of the disease did not influence the incidence, but the duration of the constitutional disturbance was a prominent factor. General vascular hypertension and arteriosclerosis were frequent and important contributing conditions. Retinal changes were present in forty percent of those cases whose lenses were clear, and in fifty-three percent where incipient cataract was present.
M. H. Post.

Kronfeld, P. C. **Metabolism of the normal and cataractous lens.** Amer. Jour. Ophth., 1933, v. 16, Oct., pp. 881-889.

Nista, E. **Research on capsular opacity and pyramidal cataract.** Ann. di Ottal., 1933, v. 61, June, p. 425.

A young man had bilateral corneal leucoma and a pyramidal cataract of the left eye. The pyramidal projection, removed with forceps preparatory to extraction of the cataractous lens, was definitely lamellar near the apex, while the basal portion was fibrillary. The lens layers extended into the projecting mass while the lenticular epithelium was arrested at the base of the formation. In a senile cataract with capsular opacity the thickened capsular portion was removed with forceps as before and the extraction completed. In the author's opinion the peculiar formation was due to atypical proliferation of the capsular epithelium anteriorly during abolition of the anterior chamber and the action of the toxin from keratitis. In two cases of capsular cataract the opacity was probably caused by degenerative changes in the superficial fibers of the lens, with proliferation of the capsular epithelium. (Six plates, bibliography.) Park Lewis.

O'Brien, C. S., and Salit, P. W. **Chemistry of the lens.** Amer. Jour. Ophth., 1933, v. 16, Oct., pp. 863-880.

Redslob, E. **The pathogenesis of expulsive hemorrhage.** Ann. d'Ocul., 1933, v. 170, Sept., pp. 737-746.

Three hours after removal of cataract from a sixty-two-year-old man expulsive hemorrhage occurred. The operation had been without accident, but the patient was arteriosclerotic. The enucleated eye had detachment of retina, choroid, and part of the ciliary body. The blood vessels of the choroid were principally involved, and one photomicrograph shows a ruptured choroidal vessel. H. Rommel Hildreth.

Schneider, R. **Cataract extraction in a hemophile.** Klin. M. f. Augenh., 1933, v. 91, Sept., p. 365.

At cataract operation on the left eye of a man aged fifty-two years, the anterior chamber filled rapidly with blood after iridectomy, but the opening of the capsule and delivery of the lens proceeded without special difficulty. The next two days the anterior chamber was still filled with blood. In the following

night the patient vomited and had violent pain. The lids were bulged like cushions, and the conjunctival sac was full of blood, the wound was ruptured, and coagulated blood protruded from it. At each attempt to remove the clots the eye continued to bleed from the interior, so the lids were closed with sutures. After a period of severe suffering the blood was finally absorbed. The pupil remained obstructed by a membrane. Upon inquiry the patient stated that he belonged to a hemophilic family. So two days before operation on the right eye he was given intragluteal injections of 5 c.c. of Clauden (a calcium preparation), 10 c.c. one day before, 10 c.c on the day of operation, and an hour before operation an injection of scopolamin and morphine. Extraction of this cataract under cocaine, with iridectomy, was perfectly successful, was not followed by hemorrhage, and yielded vision of 0.9 after correction.

C. Zimmermann.

Slocum, George. **Employment of a conjunctival bridge and suture in cataract extraction.** Arch. of Ophth., 1933, v. 10, Sept., pp. 329-341.

The paper opens with a short history of subconjunctival and bridge operations. In the author's procedure, puncture and counterpuncture are made at the corneo-conjunctival limbus, avoiding the vessels of the scleral limbus. The incision is carried upward, delimiting a broad strip of conjunctiva. This strip is freed for a distance of 6 to 8 mm. above the limbus on the temporal side and 4 or 5 mm. on the mesial side before the knife is withdrawn. If the knife is withdrawn before the bridge is completed, it may be completed with the Stevens tenotomy scissors. The unusual feature of this bridge is produced by the next incision. From the upper end of the lateral margin of the bridge, a third cut is made with the scissors, extending mesially and upward until it reaches a point about 4 mm. above the upper end of the mesial incision. An elbow, with its convexity up and out, is thus formed. A doubly-armed suture is then placed, one part through the bridge 1 mm. above the limbus, close to its lateral margin, and the other part through the conjunctiva on the opposite side, also 1 mm. above the limbus.

M. H. Post.

Van Lint. **Concerning extracapsular versus intracapsular extraction of cataract.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 171. (See Amer. Jour. Ophth., 1933, v. 16, March, p. 270.)

Van Poole, G. M. **A new stitch in cataract operation.** Amer. Jour. Ophth., 1933, v. 16, Sept., pp. 788-789.

10. RETINA AND VITREOUS

Bailliart. **The average arterial pressure in ophthalmology.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 324.

Bailliart defines average arterial pressure as that constant pressure which would produce the same volume of flow as does the variable pressure in the artery. Study of average pressure has been of value in glaucoma in determining arterial hypertension which is not revealed by determination of minimum and maximum pressures.

Phillips Thygeson.

Coppez, Léon. **Dosage of transcleral diathermocoagulation by the pyrometric electrode.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 281.

Coppez has devised a thermometer for accurately measuring the temperature obtained in transcleral diathermocoagulation. From animal experimentation he has determined the proper temperature to be 80°C. This gives the proper chorioretinal scar without thinning of the bordering retina. Ten degrees less heat gives insufficient coagulation, while ten degrees more produces unnecessary damage. (See also editorial, American Journal of Ophthalmology, 1933, volume 16, page 1004.)

Phillips Thygeson.

Courtis, B. **Anatomicopathologic considerations of hypertensive retinitis.** Arch. de Oft. Hisp.-Amer., 1933, v. 33, Aug., p. 475.

The histology of the retina is reviewed, and, since the picture described

as nephritic retinitis is neither inflammatory nor necessarily related to nephritis, the term "retinosis of hypertension" is suggested as more adequate. The author gives detailed report of a case of subacute glomerular nephritis with neuroretinitis which came to autopsy. (Microphotographs.)

M. Davidson.

Engelking, E. **Gonin or Weve?** Klin. M. f. Augenh., 1933, v. 91, Sept., p. 289.

Engelking reports his experiences with Gonin's ignipuncture and Weve's diathermy in detachment of the retina since January 1, 1932. In September, 1932, he abandoned Gonin's ignipuncture and adopted Weve's diathermy, fully convinced that this promises success in a larger number and variety of cases, and that it is simpler and equally as effective as caustic potash. The success of operative treatment of detachment of the retina is now firmly established, and conservative treatment is in most cases a mistake.

C. Zimmermann.

Espildora Luque, C. **Arteriovenous crossings and retinal vein thrombosis.** Arch. de Oft. Hisp.-Amer., 1933, v. 33, Sept., p. 531.

As long as the proximal and distal sections of a vein crossed by an artery are of the same caliber there is no compression of the vein and the various pictures observed simply indicate differing degrees of arterial hypertension and sclerosis. Whenever there is evidence of compression thrombosis becomes mechanically possible. In three cases reported, with fundus pictures, the relations between venous compression by a crossing artery and the presence of thrombosis is clearly demonstrated. M. Davidson.

Ferrer, H. **Surgical treatment of detachment of the retina.** Rev. Cubana Oto-Neuro-Oft., 1932, v. 1, Sept.-Oct., p. 302.

A retinal tear was found in not more than one-half of the seventeen cases observed, and four were operated on by the Sourdille method. Of these only one had a doubtful retinal tear. The results were brilliant in two cases, good in one case, and poor in the fourth case. The failure was in a case four months old, while the other three cases were very recent. The conclusions drawn are that there is no need to lose time in searching for the hole, and Sourdille's method is favored. One case appeared after an apoplectic stroke and may have resulted from the fall.

M. Davidson

Fritz, A. **What is the exact significance of diastolic collapse of the retinal artery?** Bull. Soc. Franç. d'Opht., 45th year, 1932, p. 321.

Fritz does not believe that diastolic collapse of the retinal arteries marks the average pressure in the vessels, but rather the elasticity of the vessel walls. He offers a laboratory experiment using two tubes of the same size but of different elasticities to prove his point. Phillips Thygeson.

Genet, L. **Treatment of retinal detachment by diathermocoagulation.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 273.

Genet describes his technique and reports results obtained in fourteen cases of retinal detachment operated upon by diathermocoagulation. Favorable results were obtained in five.

Phillips Thygeson.

Giannini, D. **Clinical contribution to the study of amaurotic family idiocy.** Ann. di Ottal., 1933, v. 61, April, p. 241, and May, p. 321.

The case which forms the basis of this study is one of bilateral and symmetrical degeneration of the retina of the retinitis pigmentosa type in a classical adiposogenital Laurence-Biedl syndrome. A girl of thirteen and one-half years of moderate intelligence with excessive fat deposits on the abdomen, thighs, legs, arms, and breasts but with childish features and underdeveloped sexual organs presented eye-ground changes that seemed to link the case closely with the degenerations characteristic of the Nieman-Pick and Gaucher disease. Endocrine relationships, sellar deformities, and nervous

pathology are discussed. (Bibliography, one plate.) Park Lewis.

Jeandelize, P., and Baudot, R. **Appearance of retinal tear without appreciable detachment.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 245. (See Amer. Jour. Ophth., 1933, v. 16, Oct., p. 937.

Lijo Pavia, J. **Moving pictures of the fundus of the eye.** Ann. d'Ocul., 1933, v. 170, Sept., pp. 778-781.

The Nordenson-Zeiss apparatus is used, being a giant ophthalmoscope fitted with a moving picture camera. As many as twenty-five pictures a second can be taken. In spite of the intense light necessary no harm has followed exposures up to seven seconds in duration. The procedure has been of value in studying arterial pulsations in relation to varying intraocular and intracranial pressures.

H. Rommel Hildreth.

Lijo Pavia, J. **The ocular fundus and general disease.** Rev. Oto-Neuro-Oft., 1932, v. 7, Sept., p. 377.

For the benefit of the general practitioner, optic atrophy, optic neuritis, macular lesions, and retinal reflexes are discussed. (Fundus photographs.)

M. Davidson.

Magitot and Lenoir. **On the nature of the retinal fluid in idiopathic detachment of the retina.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 255.

Magitot and Lenoir have studied the chemical composition of the retinal fluid from ten cases of idiopathic detachment of the retina. They state that although this fluid is often spoken of as subretinal it is in reality formed between the epithelium and the visual cells and is therefore intraretinal. It should be considered as filling a sort of cyst or retinocele. Their study revealed the following facts: (1) The retinal fluid, even in recent detachment, is always yellow, indicating old hemorrhage. (2) Cholesterin was found only once, in the form of crystals, in a case of four months' duration. (3) The quantity of albumin present in the retinal fluid is always elevated. The amount of albumin appears to be independent of the age of the detachment but is proportional to the color of the fluid. (4) The amount of glucose in the fluid is variable but is not influenced by the age of the detachment.

The authors suggest that the condition may be a cystic degeneration of the retina, similar to syringomyelia, consecutive to disease of the blood vessels. Phillips Thygeson.

Penichet, J. M. **Modified Lindner-Guist treatment of retinal detachment.** Rev. Cubana Oto-Neuro-Oft., 1932, v. 1, Sept.-Oct., p. 309.

The majority of traumatic detachments in the young respond well to any method of treatment, and furnish the successes in most of the favorable reports. The most logical method, however, in cases with degenerative myopic changes, or in the presence of choroiditis, lues, tuberculosis, or aphakia, is the Lindner-Guist. Green's automatic trephine is recommended, and the Adelman glass rods dipped in caustic are used. Cork holders are found to facilitate the handling of the rods.

M. Davidson.

Pesme, P. **A case of infantile glaucoma with pseudoglioma of the retina.** Bull. Soc. Franç. d'Opht., 1932, p. 310. (See Section 8, Glaucoma and ocular tension.)

Poyales, F. **Coats-Hippel disease.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 303.

The eye had the external exudative retinitis known as Coats' disease as well as the aneurismal condition known as Hippel's disease. Pathologic study showed the principal lesion to be in the retina, the choroid being involved little if at all. There was atheromatous degeneration of the vessel walls which led to bulb-like dilatations and small zones of hemorrhage. There was no associated general disease. The lamina vitrea was intact throughout, the nerve fibers and ganglion cells edematous, the neuroglial fibers thickened, the internal and external granu-

lar layers profoundly altered, the external limiting membrane detached, and the rods and cones completely atrophied. Throughout the retina there were masses of hemorrhage which involved the external half mainly.

Phillips Thygeson.

Rubbrecht, R. **New points of view on the treatment of retinal detachment.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 257. (See Amer. Jour. Ophth., 1933, v. 16, June, p. 564.)

Phillips Thygeson.

Satanowsky, P. **Endo- and perivasculitis of retinal vessels.** Arch. de Oft. de Buenos Aires, 1933, v. 8, Jan. and Feb., pp. 44-50.

The author, reporting such a case, believes it of luetic origin in spite of negative Wassermann. He reports another case in which thrombosis of the central vein and retinitis with considerable diminution of vision was cured by antiluetic treatment.

R. Castroviejo.

Sena, J. A., and Lagleyze, P. **The models of Prof. Lindner for reproduction of detachment of the retina.** Arch. de Oft. de Buenos Aires, 1933, v. 8, July, pp. 320-328.

The author describes the models used by Lindner to explain the mechanism and production of retinal detachment and the behavior of the intraocular structures when the eye is moved after the detachment has been produced. R. Castroviejo.

Sourdille, G. **Histologic study of two recent cases of retinal detachment.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 236.

Sourdille describes in detail the histopathology of two cases of recent retinal detachment. Briefly, the essential findings consisted of liquefaction of the vitreous body, extreme atrophy of the anterior third of the retina resulting in multiple retinal tears, edema of the posterior two-thirds of the retina with retention of normal structure, and alterations of the choroid varying from an intense congestion to atrophy with degenerative lesions of the pigment epithelium. The author concludes that the retinal lesion is the essential one, the choroidal lesions simply preparatory, and those of the vitreous secondary and accessory.

Phillips Thygeson.

Spinelli, F. **Changes in diastolic pressure of the central artery of the retina after rachicentesis, and their value in the differential diagnosis between brain tumor and serous meningitis.** Riv. Oto-Neuro-Oft., 1933, v. 10, Jan.-Feb., pp. 89-109.

In six patients affected by either a brain tumor or serous meningitis, the writer, using Bailliart's ophthalmodynamometer, tested the diastolic retinal pressure in relation to the changes that occur in intracranial tension after rachicentesis. Cerebrospinal pressure goes up again even above its original limit. A few hours later it finally falls until it reaches or almost reaches the limit it had before the puncture. The last part of the test (the decreasing stage of retinal pressure) is the most important for differential diagnosis between brain tumor and serous meningitis. In the former it reaches the limit it had before lumbar puncture, that is, above normal, while in the latter diastolic retinal pressure will reach its normal limit. (Nineteen figures, extensive bibliography.) M. Lombardo.

Tirelli, C. **Ophthalmoscopic signs and variations in the arterial pressure of the retina in concussion of the brain.** Riv. Oto-Neuro-Oft., 1933, v. 10, Jan.-Feb., pp. 86-88.

In about fifty percent of patients affected by concussion of the brain without lesions of the skull, the writer noted very fine striations of a pink-grey color around a papilla whose margins were either clear or indistinct. Some of these cases showed a hyperemic disc with venous pulsation while the ophthalmodynamometer of Bailliart did not show any increase of retinal tension. The other cases showed different degrees of inflammation of the papilla but never papilledema, and almost all showed the relation between the retinal

diastolic pressure and humoral pressure to be above normal, none below.
M. Lombardo.

Velhagen, K., Jr. **On the pre-detachment formation of the retinal hole.** Rev. Cubana Oto-Neuro-Oft., 1932, v. 1, Nov.-Dec., p. 369.

Velhagen reports a case of flat recurrent detachment without hole and twice operated upon by diathermy within two weeks, each time with complete reattachment, but presenting itself three weeks after the second operation with a red horseshoe-shaped line, without parallax and outside of the zone of the previous operations. Within three days there was noted a vesicular detachment below the red line and parallax was demonstrable. A third electrocoagulation, in which the writer combined the Lindner-Guist principle of barrage, secured reattachment and 10/10 vision. Except for the fact that no hole was observed before the first two detachments and for the possibility of postoperative retinal folds, which were however not seen, the case argues for the vitreous retraction theory. M. Davidson.

Verdaguer, P. J. **Two years experience with the Gonin operation in detachment of the retina.** Arch. de Oft. Hisp.-Amer., 1933, v. 33, Sept., p. 554.

Twenty-four out of thirty-three cases were operated on with fifteen successes. The flat inferior detachments, among them six extensive disinsertions and only two in myopes, gave the best results, with nine successes out of ten. Of the fourteen upper detachments operated on, ten being in medium or high myopes, only six were successful. The poorest results were in those cases that had started above and had migrated down before operation was resorted to. Success is determined by striking the hole. Since all cases where more than one operation was done were final successes, the percentage of successes would probably have been greater had more consented to repetition. A further practical conclusion is that large bag-like detachments, which make localization difficult, should be first evacuated as a preliminary. All operations in persons over fifty-two years were failures. Arruga's advocacy of a combination of Gonin and Guist principles is adhered to. M. Davidson.

Vogt, Alfred. **Operative treatment of detachment of the retina.** (Abstract of the official review presented at the International Ophthalmological Congress, Madrid, Spain, April 18, 1933.) Arch. of Ophth., 1933, v. 10, Sept., pp. 293-297.

A résumé of work done in the past on the retinal tear is given.

Xavier Galezowski of Paris, in 1902-1903 was the first systematically to use treatment for closure of the tear with success. Deutschmann reported a case which he operated upon in 1896. Gonin, on better clinical and anatomical foundations, continued these studies and eventually succeeded. The hole in the retina may be the result of trauma, or may occur following previous destructive process in the retina, or changes in the vitreous. Hypotony is the direct result of the tear. The principal treatments today are: (1) the Paquelin cauterization of Gonin, (2) cauterization with the galvanocautery, practiced by the author, (3) the chemical method of Guist, and (4) the diathermy of Weve, Larsson, and Safar. The author feels that the second and fourth methods are the simplest and will eventually be preferred to the others. Electrocauterization will cause damage if too prolonged. One to two seconds is now recommended, using a needle, not a loop. Two operations of this type are frequently indicated.

An official review by the same author, with greater detail, will appear soon. M. H. Post.

Wassenaar, T. **Angioid streaks of the fundus oculi.** Amer. Jour. Ophth., 1933, v. 16, Sept., pp. 759-766.

Weve, H. **Some remarks on the treatment by diathermy of retinal detachments.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 269.

Weve describes his technique of diathermic coagulation in the treatment of

retinal detachment. He has developed two different methods, the first using a ball electrode which coagulates the sclera without perforation and the second using a perforating needle. The first method is useful only in disinsertions of the retina at the ora serrata and in flat detachments. The second method may be used in all forms of tears. After localizing the tear by means of the author's own apparatus a test puncture is made with a fine needle, employing a current of 50 ma. for two or three seconds. Loss of vitreous is so minimal with the fine needle that the puncture can be repeated as many times as necessary to obturate the tear.

Phillips Thygeson.

11. OPTIC NERVE AND TOXIC AMBLYOPIAS

Badot, J. **The ocular symptoms in craniofacial dysostosis.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 349.

Badot describes the symptoms of craniofacial dysostosis. Treatment is symptomatic. Phillips Thygeson.

Benedict, W. L. **Retrobulbar neuritis and diseases of the nasal accessory sinuses.** Arch. of Ophth., 1933, v. 9, June, pp. 893-906.

The author concludes that the percentage of cases definitely due to sinus involvement is very limited and that frequently the good effects from operation are the result of the subsequent reaction, such as continued congestion of the mucosa of the sinuses and adjacent tissues, the fever following operation, and the absorption of blood. He is strongly of the opinion that similar results can be obtained by intravenous injections of triple typhoid vaccine in increasing doses up to 450 million bacteria. M. H. Post.

De Nigris, G. **Kennedy's retrobulbar neuritis and its importance in the diagnosis of frontal lobe tumors.** Riv. Oto-Neuro-Oft., 1933, v. 10, Jan.-Feb., pp. 127-129.

The patient had subjective general symptoms of a cerebral tumor and a history of rapidly failing vision of the right eye. Examination showed a pale edematous right papilla with defective vision, and left papilledema with normal vision. Post-mortem examination revealed a big lymphoangiothelioma adherent to the anterior and superior margin of the small wing of the sphenoid and also to part of the left wing, and which pressed upon the orbital surface of the right frontal lobe and part of the left one. It surrounded the right optic nerve and pressed the left in front of the chiasma.

M. Lombardo.

Esteban, M. **Malarial papillitis.** Rev. Cubana Oto-Neuro-Oft., 1932, v. 1, Sept.-Oct., p. 338.

Among over two thousand cases of malaria only one case of optic neuritis with the picture of papilledema was observed. Antimalarial treatment resulted in complete recovery in one month. M. Davidson.

Greene, H. S. N. **Oxycephaly and allied conditions in man and in the rabbit.** Jour. Exper. Med., 1933, June 1, p. 967.

There is still some uncertainty concerning the pathogenesis of these conditions. The majority opinion is that premature sutural fusion in the calvarium is fundamental in their production. Greene concludes that the cranial abnormalities result from displacement or division of primary ossification centers under the control of hereditary factors. Ralph W. Danielson.

Kaplan, E. **Acute optic neuromyelitis.** Arch. de Oft. Hisp.-Amer., 1933, v. 33, Sept., p. 545.

Three cases recently under observation are reported in detail. The noteworthy ocular finding was rapidly developing optic atrophy after an initial stage of neuritis. M. Davidson.

Lacroix, A. **Optic atrophy following treatment of paresis with stovarsol.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 388.

Two cases of optic atrophy are reported due apparently to sodium stovarsol given by intramuscular injec-

tion in the treatment of paresis, one gram three times weekly for seven weeks. Ophthalmoscopic signs of atrophy were found in the first case eight days after the last injection. Of another series of twenty cases similarly treated optic atrophy developed in only one. The author advises frequent visual field determinations during arsenical therapy. Phillips Thygeson.

Malbran, J., and Balado, M. **Chiasmatic arachnoiditis.** Arch. de Oft. de Buenos Aires, 1933, v. 8, May, pp. 199-209.

The author reports a second case in which after traumatism, vision had decreased considerably and there was marked contraction of the visual fields. After a diagnosis of chiasmatic arachnoiditis an operation consisting in opening of the optic nerve sheaths resulted in marked improvement of vision and fields. The principal symptom in such cases is bilateral atrophy of rapid course without papilledema. Diagnosis is supported by the general symptoms, by negative findings in the sella turcica, and by ventriculography. Traumatic arachnoiditis may be present without bone fracture. (Illustrations.)
R. Castroviejo.

Marquez, M. **The optic nerve crossing at the chiasm.** Riv. Oto-Neuro-Oft., 1933, v. 10, Jan.-Feb., pp. 19-25.

The author brings new arguments to Ramon Cajal's theory on the crossing of the optic nerve fibers in the chiasm. Seven sketches give a clear demonstration of the author's point of view.
M. Lombardo.

Marshall, G. G. **Cerebral pseudotumors or chronic arachnoiditis.** Amer. Jour. Ophth., 1933, v. 16, Sept., pp. 799-802.

Norea, R. **Surgical treatment of atrophy of the papilla.** Arch. de Oft. de Buenos Aires, 1933, v. 8, March, pp. 71-103.

The author deals with optic atrophy secondary to inflammation of the arachnoid surrounding the chiasm and optic nerve. Emphasis is laid on the importance of ventriculography, which should be negative in these cases. The author reports nine cases, five of inflammatory origin, two traumatic, and two of unknown etiology, all treated surgically by exposing the brain through a frontal osteoplastic flap, and dissecting away a part of the arachnoid surrounding the chiasm. In five of the cases there was improvement of vision and visual fields; in two, subjective improvement with improvement of fields, and in further two improvement of general symptoms with no improvement of either fields or vision. The author emphasizes surgical treatment to improve this type of optic atrophy. (Thirty-one illustrations and bibliography.)
R. Castroviejo.

O'Leary, P. A., and Welsh, A. L. **Treatment of neurosyphilis with malaria:** observations on nine hundred and eighty-four cases in the last nine years. Jour. Amer. Med. Assoc., 1933, v. 101, Aug. 12, p. 498.

A variety of other types of treatment was used in conjunction with the malaria therapy, so that appraisal of malaria treatment alone in relation to optic atrophy in this series of cases was impossible. In only fourteen percent of the forty-eight cases in this group was the progressive loss of vision halted even temporarily, although in twenty-two percent the process was slowed. In the majority of cases of bilateral hemianopia, temporary decrease in the visual fields was usually noted after malaria treatment, whereas in two cases in which there was rapidly progressive loss of vision complete blindness developed during the treatment. Improvement in the other symptoms of tabes dorsalis was as a rule marked, even though there was a gradual decrease in vision. (Discussion.)
George H. Stine.

Pagani, M. **Papilledema and serous meningitis.** Riv. Oto-Neuro-Oft., 1933, v. 10, Jan.-Feb., pp. 83-85.

Papilledema is the principal symptom of serous meningitis, and its recurrent swelling and regression correspond to the course of the meningitis.

The writer describes the case of a patient affected by recurrent attacks of headache and obscuration of sight. Radiographies showed the brain signs of increased intracranial pressure, but there was no focal sign of tumor. The rachicentesis showed increased pressure at the first test only. Vision was still normal four years after onset.

M. Lombardo.

Pascheff, C. **Researches on certain rare retrobulbar diseases of the optic nerve.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 372.

Pascheff divides the retrobulbar neuritides into three classes, orbital, nasal, and toxic, according to their pathogenesis. Under the first class the author describes a case of stasis of the papilla due to mechanical blocking of the vessels by an orbital echinoccoccic cyst, and a case of optic atrophy in congenital oxycephaly. Under the second class he describes three cases of retrobulbar neuritis apparently of nasal origin. While central and paracentral scotomata are the commonest findings, edema of the papilla may also occur. He states that the disease may heal without nasal surgery after the use of adrenalin packs. As illustrating the third class the author cites two cases of ethyl-alcohol poisoning. The first case developed a papilledema and an absolute central scotoma. The peripheral vision remained normal. In the second case there was no papilledema but central vision returned while the peripheral field remained contracted. In the two cases the pupils were dilated and inactive. Phillips Thygeson.

Sabbadini, D. **Considerations on tabetic optic atrophy which had been subjected to malaria therapy.** Riv. Oto-Neuro-Oft., 1933, v. 10, Jan.-Feb., pp. 43-72.

The author describes in detail the clinical history of six patients affected by tabes or taboparalysis with ocular symptoms, which had been treated, from six to seven years before, with malaria pyrotherapy. Two of the patients recovered entirely, one showed permanent improvement, two a slight deterioration from the previous marked improvement, and one no effect. In those cases in which mercury was used after the malaria therapy, the condition of the eyes became worse, while after salvarsan no deterioration was noted. The effect was not so good as regards the condition of the pupils and the ophthalmoplegias. The author concludes that in patients affected by tabetic atrophy malaria pyrotherapy is to be used in preference to any antiluetic treatment, and that this therapy should be followed by neosalvarsan.

M. Lombardo.

Weekers, L. **A new clinical sign for differential diagnosis and prognosis of retrobulbar neuritis.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 358. (See Amer. Jour. Ophth., 1932, v. 15, Nov., p. 1099.)

Wilson, G., and Darkes, W. F. **Unilateral choked disc due to chronic tonsillar infection.** Jour. Amer. Med. Assoc., 1933, v. 100, April 22, p. 1233.

Removal of the tonsils, in both cases badly diseased, produced prompt improvement, and relatively speedy return to normal vision and normal state of the involved nerve. In one case the symptoms at onset resembled those of retrobulbar neuritis.

George H. Stine.

12. VISUAL TRACTS AND CENTERS

Borel, G. **Pure traumatic word blindness.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 417.

Borel describes in detail the first case of pure word blindness which was found by him in 1887 and which was studied by Charcot and Déjerines. The disease remained unchanged over a period of five years until the death of the patient. The autopsy by Déjerines revealed a recent cerebral hemorrhage, cause of death, and a small old lesion located in the angular gyrus, the cause of the alexia. Borel discusses the psychological reactions of a patient having word blindness. A certain number attempt suicide.

Phillips Thygeson.

De Meo, E. **Clinical contribution to study of the late syndrome of concussion.** Riv. Oto-Neuro-Oft., 1933, v. 10, Jan.-Feb., pp. 115-121.

The author examined fifty patients who from one to two years previously had sustained skull traumatism with or without fracture, and who had shown the so-called "late concussion syndrome," including neurologic, psychic, aural, and ocular symptoms. The ocular symptoms are: retinal asthenopia, diplopia, contraction of visual fields, transitory obscuration of sight, increased diastolic pressure of retinal vessels, striations around the papilla, mydriasis, anisocoria, and sluggish pupillary reactions. The author considers the subject also from the legal standpoint. M. Lombardo.

Hare, C. C., and Dyke, C. G. **Roentgen therapy of pituitary tumors.** Arch. of Ophth., 1933, v. 10, Aug., pp. 202-224.

The authors report results obtained from roentgen-ray treatment of twenty patients with adenomas of the pituitary gland. There was marked gain in vision in five, while in fifteen the general condition was improved. In five patients there was some loss of vision; in two of them so much so that an operation was later performed. Of ten patients under observation for from one to four years, vision and fields returned to normal in one, and in two there was marked improvement of both vision and fields. Of ten observed for from two to twelve months, the vision of one was greatly improved. In the nine remaining it was unchanged or slightly improved. M. H. Post.

Morselli, G. E. **Focal syndrome of basal nerves.** Riv. Oto-Neuro-Oft., 1933, v. 10, Jan.-Feb., pp. 130-132.

A man forty-seven years old became affected by intense fronto-orbital headaches, which a few months later were followed by bilateral blindness, mydriasis, left divergent strabismus and bilateral limited motion of the eyes upward, and bilateral optic atrophy. Post-mortem examination showed thick tissue adherent to the dura, surrounding the sella, and diffused to the anterior and the median fossae. Microscopically this was found to be neoplastic.

M. Lombardo.

13. EYEBALL AND ORBIT

Edgerton, A. E., and Stowe, W. P. **Lipoma of the orbit.** Amer. Jour. Ophth., 1933, v. 16, Oct., pp. 900-902.

Esteban, M. **Surgical treatment of pulsating exophthalmos.** Rev. Cubana Oto-Neuro-Oft., 1932, v. 1, Sept.-Oct., p. 335.

Ligation of the superior ophthalmic vein takes care of the exophthalmos only. To attack the aneurism, simultaneous ipsolateral ligation of the common carotid and the internal carotid is advocated, since that of the internal carotid alone often fails, that of the common carotid is either ineffective because of anastomosis from the opposite side or is dangerous because of embolism, and bilateral ligation of the common carotids is dangerous.

M. Davidson.

Gresser, E. B. **Unilateral exophthalmos and epidural abscess.** Amer. Jour. Ophth., 1933, v. 16, Sept., pp. 807-808.

Koch, C. and Brunetti, L. **Study of the morphological correlation between the orbit and the living eyeball with the aid of a new system of radiographic orbitometry.** Ann. di Ottal., 1933, v. 61, May, p. 342.

From a special technique, with mathematical calculations, the author concludes that in myopic anisometropia the orbit containing the globe having the highest ametropia is smaller and less deep than the other, whereas in hypermetropia the orbit containing the ball having the higher degree of ametropia is deeper and larger than the other orbit. In anophthalmos the orbit in which the globe is lacking is less full but not less deep than the other orbit. It is held that there exists an inverse correlation between the curvature of the retinal cup and that of the orbit, arising from embryonic dismensional correlations between the encephalon and the orbit. (Bibliography.)

Park Lewis.

Lawson, L. J. **Metastatic panophthalmitis following pneumococcic otitis media.** Jour. Amer. Med. Assoc., 1933, v. 101, Aug. 19, p. 599.

In a boy aged four years, rapidly progressive metastatic panophthalmitis developed after pneumococcic otitis media of four weeks duration. The eye was completely destroyed within a week after onset. Lens and cornea were replaced by seminecrotic tissue fused with the iris and ciliary body and densely infiltrated with polymorphonuclear leukocytes. The choroid, sclera, and retina showed perivascular lymphocytic infiltration.

George H. Stine.

Lijo Pavia, J. L., and Portela, C. G. **Bilateral absence of lens. Microphthalmos and unilateral hyalitis. Endocrine disturbance. General toxi-infection.** Rev. Oto-Neuro-Oft., 1932, v. 7, Oct., p. 432.

In a case reported, the antenatal malformations are referred to the mother's cardiorenal insufficiency, and the hyalitis and endocrine imbalance to postnatal focal infections—tonsils and intestinal amebiasis. M. Davidson.

Valière-Vialeix. **A case of pulsating exophthalmos treated and cured by ligation of the orbital veins at the entrance to the orbit.** Ann. d'Ocul., 1933, v. 170, Sept., pp. 747-760.

The patient, a man aged thirty-seven years, developed arteriovenous aneurism after injury. The veins were ligated and in time the headaches, bruit, pulsation, and other symptoms disappeared. It is believed that ligating the veins causes thrombosis that spreads to the cavernous sinus. Glaucoma appeared later, but optic atrophy had followed the injury, x-ray giving evidence of damage to the nerve in the foramen. H. Rommel Hildreth.

Weskamp, C. **Spontaneous aneurism of the carotid artery in the cavernous sinus.** Arch. de Oft. de Buenos Aires, 1933, v. 8, June, pp. 245-254.

This case had all the characteristic symptoms except pulsation. The symptoms disappeared in about four weeks, and three months later the patient seemed to be completely cured. The absence of pulsation was probably due to smallness of the arterial opening in the sinus, and this explains also the spontaneous cure. (Three photographs.)

R. Castroviejo.

14. EYELIDS AND LACRIMAL APPARATUS

Carreras, B. **A case of Mikulicz syndrome.** Arch. de Oft. Hisp.-Amer., 1933, v. 33, Aug., p. 506.

The case reported showed ocular in addition to salivary gland involvement. The pathologist's report on a biopsy specimen however describes the condition as lymphosarcoma with relative absence of glandular tissue, which latter tissue the writer believes is early destroyed by growth of lymphadenoid tissue. M. Davidson.

Cepero, G., and Comas, C. **Diathermic depilation in ophthalmology.** Rev. Cubana Oto-Neuro-Oft., 1932, v. 1, Sept.-Oct., p. 331.

Diathermy makes many plastic operations unnecessary, produces more permanent results than electrolysis, with little reaction and scarring, and permits radical destruction of from ten to twelve lashes in a lid at one sitting. The Bordier method and needle are recommended. M. Davidson.

Fazakas, A. **Double lacrimal canaliculi and tear flow.** Klin. M. f. Augenh., 1933, v. 91, Sept., p. 395. (Ill.)

Two chief groups are distinguished according to the ending of the canaliculi in a common opening or separately. In the majority of cases of the first group the common opening forms a groove and the canaliculi run one above the other. In restoring the disturbed mechanism of tear conduction in such cases one must consider those in which there is no epiphora, because one tear point is at the proper place.

C. Zimmermann.

Hughes, W. L. **Removal of the lid, with plastic repair.** Arch. of Ophth., 1933, v. 10, Aug., pp. 198-201.

Removal of a tumor involved the inner two-thirds of the lower lid of the right eye, including the underlying conjunctiva. The upper lid and the remaining one-third of the lower were roughened and sutured together to prevent shrinkage of the latter. A flap of buccal mucous membrane fastened over a stent was inserted into a pocket under the skin of the upper lid, where it was allowed to remain for three weeks under a pressure bandage. The skin and mucous membrane were then transplanted to fill in the tissue lost by removal of the tumor. The gap in the skin of the upper lid was sutured without resulting deformity, and finally the two lids were separated from each other. M. H. Post.

Junès, E. **The operation of choice in trachomatous entropion of the upper lid. Low tarsotomy and horizontal sutures.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 70. (See Amer. Jour. Ophth., 1933, v. 16, Jan., p. 89.)

Nicolau. **Epidemic acute dacryoadenitis.** Ann. d'Ocul., 1933, v. 170, Sept., pp. 772-778.

Reporting on ten cases the author finds in two instances two cases in the same family. All the cases occurred during the winter months and lasted from one to three months. The local findings were in each case accompanied by fever and general symptoms. Extensive clinical and laboratory studies on these cases by the author and others have failed to explain the etiology. The author feels that the cause is probably a filterable virus.

H. Rommel Hildreth.

Satanowsky, P. **Blepharochalasis and internal secretions.** Arch. de Oft. de Buenos Aires, 1933, v. 8, March, pp. 112-115.

In a patient with blepharochalasis, thyroid hyperfunction, and ovarian insufficiency, treatment with ovarine and lugol solution not only improved the blepharochalasis, but also the endocrine imbalance. (Two photographs.)

R. Castroviejo.

Satanowsky, P. **Partial cryptophthalmos with epicanthus and congenital ptosis. Author's surgical procedure to correct it.** Arch. de Oft. de Buenos Aires, 1933, v. 8, June, pp. 255-265.

The author reports two cases. His method consists of splitting the skin and conjunctiva of the inner canthus at the epicanthal fold between the lacrimal canaliculi, in order to widen the palpebral fissure, at the same time correcting the epicanthus and improving the ptosis. (Ten photographs and bibliography.) R. Castroviejo.

Toth, Z. **Vertical roentgen picture of the nasolacrimal canal.** Klin. M. f. Augenh., 1933, v. 91, Sept., p. 390. (Ill.)

In vertical roentgen photography, the technique of which is described, the osseous and membranous nasolacrimal ducts and their immediate surroundings can be observed in vivo. In eighteen of twenty cases of stenosis the bone was intact. This method confirms the results of Rollet and Bussy, who in one hundred cases of diseases of the tear sac found no instance of stenosis of the osseous duct; and also the observation of Axenfeld that the osseous duct is rarely affected.

C. Zimmermann.

Vittadini, A. **Contribution to recognition of the histopathologic alterations of the lacrimal sac in chronic dacryocystitis.** Arch. di Ottal., 1933, v. 40, April, pp. 150-179.

The author has studied histopathologically twenty lacrimal sacs which were extirpated because of chronic purulent dacryocystitis. By a series of photomicrographs he shows the changes in size of the lacrimal sac and its cellular constituents. He denies the presence of any valves other than those of Rosenmüller and Krause, affirms the presence of a few glands, and denies any relation between follicles in the lacrimal sac in chronic dacryocystitis and the nodules found in trachoma.

Herman D. Scarney.

15. TUMORS

Adrogue, A., and Lagleyze, P. **Mixed tumors of the lacrimal gland.** Arch. de

Oft. de Buenos Aires, 1933, v, 8, July, pp. 305-319.

The authors study the subject from the standpoint of symptomatology, differential diagnosis, and prognosis. Two cases are reported which were successfully treated by surgery, and the histopathologic examination showed them to have all the characteristics of mixed tumors of the orbit.

R. Castroviejo.

Damel, S. C. **Mixed tumor of the orbit.** Arch. de Oft., de Buenos Aires, 1933, v. 8, May, pp. 187-197.

A tumor about the size of an egg, and occupying the left orbital cavity, was enucleated. Microscopic examination showed it to be a mixed tumor of the orbit. (Photographs and bibliography.)

R. Castroviejo.

Giannini, D. **Criteria of operability and modes of treatment of orbital tumors.** Ann. di Ottal., 1933, v. 61, July, p. 521.

A sarcoma of the orbit deeply involving the contiguous tissues was removed by Elschnig with the inner orbital plate, and with complete evacuation of the antrum of Highmore. This was followed by the employment of x-ray and plastic surgery. One and a half years later the wound had healed and there had been no metastasis. Operative measures should be undertaken even when complete cure is not to be expected. (Bibliography.)

Park Lewis.

Lopez Enriquez, M. **Rhabdomyoma of the lid.** Arch. de Oft. Hisp-Amer., 1933, v. 33, July, p. 419.

To three acknowledged cases of rhabdomyoma of the lids hitherto published, the writer adds another. When seen, in a boy of ten years, it was five months old, of the size of a walnut, emerging from the conjunctival surface to cover the lower lid and reaching down to the middle of the nose. Examination with nuclear stains and low power suggested sarcoma. Selective staining revealed the myofibrillary structure of the protoplasm, of somewhat atypical direction and grouping, but definitely establishing the true nature of the neoplasm. (Microphotographs and drawings.)

M. Davidson.

MacMillan, J. A., and Cone, W. V. **Solitary neurofibroma of the orbit.** Arch. of Ophth., 1933, v. 10, July, pp. 51-57.

Two types of encapsulated tumor of the peripheral nerves are recognized, perineural fibroblastoma and neurofibroma, the first benign, usually solitary, arising from the connective tissue framework of nerves, the second an encapsulated fibroblastic growth arising from the nerves and permeated by nerve fibers. The authors present a case falling in the second group. Five previously reported cases are mentioned.

M. H. Post.

Marin Amat, M. **Melanotic sarcoma developing on a pterygium.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 105. (See Amer. Jour. Ophth., 1933, v. 16, Feb., p. 188.)

Meyer, S. J., and Kubik, J. **A case of melanotic sarcoma of the iris.** Amer. Jour. Ophth., 1933, v. 16, Oct., pp. 893-897.

Van der Straeten and Maldague. **Four observations of sympathoma of the suprarenal capsule with ocular symptoms.** Arch. d'Opht., 1933, v. 50, Aug., p. 513.

The rareness of orbital metastases from sympathoma is questioned as three cases were seen within a few months. All were in children, the oldest fourteen years of age. The disease begins in the medulla of the suprarenal, and metastases often first draw attention to the malady, seeking out particularly the bones of the orbit and causing marked exophthalmos. (Nine photographs.)

M. F. Weymann.

16. INJURIES

Argañaraz, R., and Sena, J. A. **Orbital ocular alterations in skull fractures; lesions of the optic nerve; pulsatile exophthalmos.** Arch. de Oft. de Buenos Aires, 1933, v. 8, Jan. and Feb., pp. 6-45.

The authors review the different sensorial and motor eye symptoms brought about by skull and orbital fractures. Three cases are reported, two of atrophy of the optic nerve and one of pulsatile exophthalmos. In the three cases there was a history of trauma, and x-ray detected changes in the optic canal corresponding to the site of the lesion. (Twenty-five illustrations and bibliography.) R. Castroviejo.

Delord, Émile. **Ocular disturbance following compression of a frontal hematoma.** Arch. d'Opht., 1933, v. 50, Aug., p. 565.

A woman of thirty years developed a frontal hematoma from a cut in an automobile accident. A month later a pressure bandage was applied for three days. The hematoma disappeared, but the conjunctiva and lids became swollen. This was followed by an optic neuritis in the left eye, which cleared up after several days. No source was found for the optic neuritis except possibly the mechanical and toxic effect of the hematoma. M. F. Weymann.

Greenbaum, S. S. **Dermatoconjunctivitis due to Lash-Lure, an eyelash and eyebrow dye.** Jour. Amer. Med. Assoc., 1933, v. 101, July 29, p. 363.

Twelve days after dyeing the eyelashes with Lash-Lure, a dye containing an aniline derivative and a large quantity of magnesium, a woman developed an intense dermatitis of the lids and a conjunctivitis which responded somewhat to local treatment, but was cured only by removal of the eyelashes with a pair of scissors. The allergic nature of the condition was indicated by the twelve days' incubation period between application and reaction. Multiple sensitization was either present or induced, as indicated by the severe relapse following the use of either metaphen or the chemicals used to flush the eye. (One photograph.)
George H. Stine.

Klauder, J. V. **Ocular syphilis: 4. interstitial keratitis and trauma; clinical, experimental, and medicolegal aspects.** Arch. of Ophth., 1933, v. 10, Sept., pp. 302-328.

This paper deals with the question whether interstitial keratitis may be the result of trauma, especially in its medicolegal aspects. That other syphilitic lesions are so initiated and localized appears well established. Kümmel formulated certain requirements: proof of injury such as might cause the lesion, a connecting chain of symptoms of irritation and inflammation from the time of injury to the onset of inflammation, and that the initial site of the keratitis should lie at the place of injury.

The author reports three cases fulfilling these requirements, and two in which interstitial keratitis appeared within three days following alleged or actual injury. Experimental studies were inconclusive.

Three claims under the Workmen's Compensation Act in Pennsylvania, Massachusetts, and Michigan respectively are reported, in all of which the awards were granted to the plaintiff. The author concludes that the decision is purely a judicial one, but that the appearance of interstitial keratitis in the uninjured eye while the injured one is still suffering from active inflammation may well be regarded as a logical consequence of trauma.
M. H. Post.

Levine, Joseph. **Growth of corneal epithelium into anterior chamber.** Amer. Jour. Ophth., 1933, v. 16, Sept., pp. 796-798.

Sena, J. A. **Luxation of the lens into the space of Tenon.** Arch. de Oft. de Buenos Aires, 1933, v. 8, April, pp. 127-133.

Five such cases reported in the literature are mentioned, and the author reports one more case in which, in an automobile accident, the sclera was ruptured for about 50 mm. in the upper temporal quadrant near the equator. Two months after the accident the lens was removed through a conjunctival incision and the eye has remained quiet ever since. R. Castroviejo.

Wassenaar, T. **Spontaneous expulsion of an intraocular foreign body.** Amer. Jour. Ophth., 1933, v. 16, Oct., pp. 808-809.

17. SYSTEMIC DISEASES AND PARASITES

Adamantiadis, B. **Ocular complications of acne rosacea.** Ann. d'Ocul., 1933, v. 170, Sept., pp. 760-766.

The patient, a forty-year-old woman (1925), had developed ocular acne in the previous year although the facial condition was much older. During the successive year three attacks involved the cornea. During a quiet phase iris nodules were discovered near the lesser circle. These disappeared after two weeks and for two and one-half years there were no more attacks. In relation to later attacks, iris nodules were found, sometimes with precipitates on the endothelial surface of the cornea.

H. Rommel Hildreth.

Bistis, J. **Ocular complications from arsenicals.** Rev. Oto-Neuro-Oft., 1932, v. 7, Sept., p. 369.

One hundred cases treated with salvarsan were observed for ocular complications and none found. One case treated with acetylarsan and reported in detail exhibited a hemorrhagic neuroretinitis attributed to the drug. In ocular syphilis the writer begins treatment with mercury and bismuth, and resorts to salvarsan only if results are unsatisfactory, and in the absence of vascular hypertension and renal insufficiency. M. Davidson.

De Nigris, G. **Oculogyral syndrome in a neuroluetic patient.** Rev. Oto-Neuro-Oft., 1933, v. 10, Jan.-Feb., pp. 73-75.

A lady, twenty-nine years old, four years after marriage with a luetic man, showed a parkinsonian syndrome, frequent attacks of headache and tonic spasmodic torsion of head and eyes upward and to the left. The pupils were of different size, reacted to accommodation and sluggishly to light, and six months after malaria therapy the patient showed marked improvement. Previous treatment with arsenobensols had been of no apparent benefit. (One figure.) M. Lombardo.

Marquez. **Concerning hydatid cyst of the orbit.** Bull. Soc. Franç. d'Opht., 1932, 45th year, p. 396. (See Amer. Jour. Ophth., 1933, v. 16, Jan., p. 91.)

Ohmart, W. A. **Experimental tuberculosis of the eye.** Amer. Jour. Ophth., 1933, v. 16, Sept., pp. 773-778.

Pereira, R. F. **Hydatid cyst of the orbit.** Arch. de Oft. de Buenos Aires, 1933, v. 8, April, pp. 134-165.

After a short review of some cases reported in the literature, the author discusses in detail the etiology, pathogenesis, pathologic anatomy, symptomatology, differential diagnosis, and treatment of hydatid cyst of the orbit. Two cases are reported which were successfully treated by surgery. (Bibliography.) R. Castroviejo.

NEWS ITEMS

News items in this issue were received from Drs. Samuel Horton Brown, Philadelphia; William H. Crisp, Denver; M. Davidson and M. Uribe Troncoso, New York. News items should reach **Dr. Melville Black, 424 Metropolitan Building, Denver,** by the twelfth of the month.

Deaths

Dr. Thomas Faith, Chicago; aged sixty-one years, died, October 16, of arteriosclerosis and cerebral hemorrhage.

Dr. Ira Oscar Denman, Toledo, Ohio; aged sixty-one years, died, September 28, of heart disease.

Dr. Gerald Harrison Grout, New York; aged fifty-three years, died, September 25.

Miscellaneous

The committee of the Philadelphia County Medical Society appointed last spring to direct the ophthalmic examination of school children has launched this mass enterprise for the present session. Under this arrangement all school children showing defective vision when examined by the school physician will be scheduled as to the financial status of their parents and routed to a group of ophthalmologists who have agreed to accept such children as patients in accordance with a fee schedule also previously agreed upon. A group of opticians will fill such prescriptions as may be written for glasses at a uniform, low price upon certification of

the ophthalmologist that the patients belong in this class.

The editor of the Abstract Department would be glad to hear from colleagues who would care to assist in abstracting from any one or more languages, English or foreign.

The Annual Meeting of the National Society for the Prevention of Blindness will be held in the Russell Sage Foundation Building, 130 East 22nd Street, New York City, on Friday afternoon, Nov. 24, it is announced by Lewis H. Carris, managing director. The principal address, on the subject of "Light and Vision," will be made by Mr. Preston S. Millar, president of the Electrical Testing Laboratories, who is a member of the Society's board of directors.

Three other agencies will cooperate with the National Society for the Prevention of Blindness in holding a joint luncheon conference in the Hotel Pennsylvania Saturday, Nov. 25, to discuss the various problems of medical social work in eye hospitals and clinics. The cooperating agencies are:

North Atlantic District of the American Association of Hospital Social Workers;

Prevention of Blindness Department of the New York State Commission for the Blind;

Medical Social Service Section of the Welfare Council of New York City.

Speakers at the luncheon conference will include Dr. John M. Wheeler, director of the Institute of Ophthalmology, Columbia University Medical Center; Mrs. Francis W. Little, of Baltimore, executive secretary of the Maryland Society for the Prevention of Blindness; and Miss Ruth E. Lewis, of St. Louis, associate director of the Social Service Department of Washington University Clinics and Allied Hospitals.

Societies

The Society of Ex-House Surgeons of the Manhattan Eye, Ear and Throat Hospital held a two day reunion, September 22-23. The program included clinics and demonstrations at the hospital and a dinner at the New York Physicians Club. Dr. Walter Guernsey Frey, Jr., is secretary of the organization.

The eye section of the Philadelphia County Medical Society held its inaugural scientific meeting on Tuesday evening, October 10, with an attendance of over 125. Dr. George E. de Schweinitz read a paper entitled, "Concerning the Ocular Manifestations of Arteriosclerosis, Nephritis, Diabetes and Increased Intracranial Tension," which was illustrated by drawings and water colors. The officers of this section, who have been reported previously in this column, are assisted by an executive committee of thirteen members. In order to be eligible for membership one must belong to the County Society and must have signed a card of application. To date 95 such signatories have been listed. The activities scheduled in advance for the society indicate for it a prosperous existence.

Personals

Dr. Julio López Lacarrère has been appointed chief of the department of ophthalmology, Hospital del Niño Jesús, Madrid.

Among professional men deprived of the right to teach in Germany because of racial prejudice is Dr. Ernst Metzger, ophthalmologist, of Frankfort-am-Main.

Dr. Josef Igersheimer, who has been called to Constantinople as professor ordinarius of ophthalmology, left for his new post early in November. About 25 non-aryan professors have found places there.

Dr. John M. Wheeler, New York, was elected vice-president of the Society of Plastic and Reconstructive Surgery at its annual meeting, October 18.

Drs. John O. McReynolds and Edward H. Cary, Dallas, were speakers at the twenty-seventh annual meeting of the Southern Medical Association held at Richmond, Va., in November.

Mr. Arnold Sorsby has been elected Hunterian Professor at the Royal College of Surgeons for 1933-34. He will deliver his lecture, the subject of which is "Retinal Abiotrophy," on Monday, January 29, 1934.

Dr. Clifford B. Walker has been made professor of clinical ophthalmology in the clinical department of the College of Medical Evangelists, Los Angeles, and Dr. William A. Boyce, for many years professor of ophthalmology, is now head of the department.

Dr. William Stewart Duke-Elder, ophthalmic surgeon to St. George's Hospital, London, recently received the Nettleship gold medal and prize awarded by the Ophthalmological Society of the United Kingdom for the most valuable contribution to ophthalmology during the past three years.

Dr. William Campbell Posey has been appointed chairman of the committee on conservation of vision of the Philadelphia County Medical Society. Associated with him is a group of prominent ophthalmologists, a number of whom are interested in medico-sociologic problems of this character.

The British Journal of Ophthalmology reports that the William Mackenzie medal was this year awarded to Professor Jules Gonin of Lausanne in recognition especially of his treatment of detachment of the retina. Presentation of the medal was in the hall of the Royal Faculty of Physicians and Surgeons, Glasgow, on Friday, October thirteenth, when Professor Gonin delivered the William Mackenzie Memorial Lecture on "The evolution of ideas concerning retinal detachment within the last five years."

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Index compiled by EMMA S. BUSS